

HA-96-007

**AUDIT
REPORT**

**AIRCRAFT CONSOLIDATION AT THE
DRYDEN FLIGHT RESEARCH CENTER**

NASA Headquarters

August 12, 1996



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

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National Aeronautics and
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Reply to Attn of:

W

AUG 12 1996

TO: AD/Acting Deputy Administrator

FROM: W/Inspector General

SUBJECT: Final Report on Audit of Aircraft Consolidation at the
Dryden Flight Research Center (DFRC)
Assignment No. A-HA-96-002
Report No. HA-96-007

The Office of Inspector General (OIG) has completed an audit of NASA's plan to consolidate airborne science and platform research and related support aircraft at the Dryden Flight Research Center (DFRC). This is our third and final report on the consolidation initiative. Our audit objective was to determine the reasonableness of the assumptions underlying NASA's consolidation plan and the accuracy of the Comptroller's (Code B) cost assessments.

Overall, we found that DFRC's facilities are adequate for housing the transferred aircraft and offers sufficient office space for the additional 290 employees that will accompany the 21 transferred aircraft. We believe DFRC can perform the operation and maintenance functions necessary for the transferred aircraft. However, we have concluded that the proposed consolidation of research and support aircraft at DFRC is not cost effective nor an efficient use of Agency resources. We found that many of Code B's assumptions and cost savings projections were optimistic, and associated cost estimates did not adequately reflect actual cost history. In addition, we do not believe that NASA has adequately evaluated the adverse impact that aircraft consolidation would likely have on program research.

On June 4, 1996, we issued a draft report of Code B's March 15, 1996, assessment and met with NASA management on June 18, 1996, to discuss the draft. On June 28, 1996, NASA management submitted its written response. That response is included in its entirety as Appendix II. Based on management's response and subsequent information, we made appropriate changes.

Our final analysis of Code B's March 15, 1996 assessment estimated nonrecurring costs of \$11.3 million and annual savings of \$218,049, resulting in a payback period of 52 years. If the cost of money (discount rate) is factored in, we project that NASA would never recover its financial investment.

In our June 4 draft report, Recommendation 1 stated that NASA should reevaluate its decision to implement the current aircraft consolidation plan because it is not cost effective. This was not done. Code B only looked at one option, consolidation at DFRC. NASA management's options ranged from DFRC assuming only the management function as the Center of Excellence for Aircraft Research (and receiving no research aircraft from the other Centers), to taking over all the research aircraft. No effort had been made by management to evaluate and weigh the range of alternatives despite the fact that previously Code B (in its assessment issued on February 8, 1996) suggested alternatives to consolidation at DFRC might be more cost effective. Accordingly, we request a reconsideration by management of Recommendation 1.

While NASA's response did not specifically address Recommendation 2, it did reiterate that decommissioning aircraft would produce an estimated annual savings of \$21.8 million. Therefore, we infer that management intends to decommission the aircraft. Thus, the OIG considers NASA's actions to be responsive. We will followup with management to review planned dates and actions to decommission the aircraft.

Our final analysis does not audit potential costs and savings related to issues about which we were informed since we issued the June draft report. For example, management discussions are now ongoing about the DC-9 microgravity research, ranging from basing the aircraft at DFRC and flying microgravity missions out of LeRC to contracting out for the research. In addition, transition plans for LaRC's B-757 aircraft are currently being revisited due to project milestone concerns, cost, and design configuration changes. However, we do discuss these and other potential cost and programmatic impacts in Appendix III.

We endorse and want to continue to assist NASA management's efforts to do business more efficiently. However, our audit does not confirm that the planned consolidation is efficient or cost effective. Accordingly, we reaffirm our previous position that NASA reevaluate its decision to implement the current aircraft consolidation plan and perform a thorough analysis which includes major cost and research impacts. Before taking steps to terminate the capabilities and synergies that the research platform aircraft bring to LaRC, WFF, LeRC and ARC, we recommend that NASA management fully consider the alternative options available, not just one.

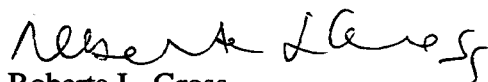

Roberta L. Gross

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Table Of Abbreviations/Acronyms

A/C	Aircraft
ARC	Ames Research Center
Code B	Office of the Chief Financial Officer/Comptroller
Code R	Office of Aeronautics
Code U	Life & Microgravity Science & Applications
Code Y	Office of Mission to Planet Earth
DFRC	Dryden Flight Research Center
FAA	Federal Aviation Administration
GHS	Guaranteed Home Sales
HHG	Household Goods
HQ	NASA Headquarters
JSC	Lyndon B. Johnson Space Center
LAN	Local Area Network
LaRC	Langley Research Center
LeRC	Lewis Research Center
MTPE	Mission to Planet Earth
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
OIG	Office of Inspector General
PCS	Permanent Change of Station
RASCAL	Rotorcraft/Aircrew Systems Concepts Airborne Laboratory
SLD	Supercooled Large Droplet
SSC	John C. Stennis Space Center
TSRV	Transport System Research Vehicle
WFF	Wallops Flight Facility
WATR	Western Aeronautical Test Range

AUDIT OF AIRCRAFT CONSOLIDATION AT THE DRYDEN FLIGHT RESEARCH CENTER (DFRC)

NASA HEADQUARTERS, WASHINGTON DC

EXECUTIVE SUMMARY

PURPOSE

NASA's budget has decreased dramatically in recent years and more lean years are anticipated. In response to this, NASA's 1995 Zero Based Review (ZBR) recommended the consolidation of all NASA science platform and research aircraft at DFRC, with no loss of research capability, in order to streamline infrastructure and improve the efficiency of its aeronautics programs. The airborne science and platform research aircraft involved in the consolidation are presently located at the Ames Research Center (ARC), Langley Research Center (LaRC), Lewis Research Center (LeRC), and Wallops Flight Facility (WFF).

Our audit objective was to determine the reasonableness of the assumptions underlying NASA's consolidation plan and the accuracy of subsequent cost assessments performed by the NASA Comptroller's office.

BACKGROUND

The concept of consolidation has been the subject of many NASA studies. See Appendix I for a chronology of consolidation events dating from November 1993.

Airborne science aircraft include large multi-engine testbeds, such as the DC-8 (ARC), the B-757 (LaRC), the DC-9 (LeRC) and the C-130Q (WFF). As described by a NASA aircraft operations branch: "Each aircraft is uniquely configured to fly research missions in support of various science or aeronautics programs, and are deeply integrated within their Center's technical support infrastructure. In general, the costs associated with the operation of these aircraft are principally driven by research support requirements, i.e., modifications, research hardware, flight hours, and travel as required to support the technical program. Because testbed aircraft are such an integral part of each Center's programs and technical support

infrastructure, where an aircraft is based has a significant effect on operating costs and quality service to programs."

DFRC's current complement of aircraft are primarily used for flight research, which involves using the planes as the actual test articles for aerodynamic configurations and direct flight control hardware. However, the majority of the aircraft transferring to DFRC are not flight research aircraft but airborne science aircraft.

DFRC is primarily a flight research center, not an airborne science research center. The airborne science research centers have built up synergism and capabilities over the years between the researchers, experiment integrators, mission planners, engineers and operations personnel (including specially trained flight crews).

RESULTS IN BRIEF

While DFRC can support the transferred aircraft, the proposed consolidation is not cost effective nor an efficient use of Agency resources. Many of Code B's assumptions and cost savings projections were optimistic, and its associated cost estimates did not adequately reflect actual cost history. Also, NASA has not adequately evaluated the impacts that aircraft consolidation would have on current research programs. Dismantling established research facilities and moving the research aircraft will cause inefficiencies during planning, integration and deployment.

On June 4, 1996, the OIG issued a draft report. The OIG adjusted the payback period stated in our June draft from 72 years to 52 years to account for items contained in both nonrecurring and recurring additional travel which we also included in other cost categories. Accordingly, based on NASA's current consolidation plan, we estimate nonrecurring, initial investment costs will be \$11.3 million with net annual recurring savings of \$218,049. If the cost of money (discount rate) is factored in, we project that NASA would never recover its financial investment. See Exhibit I for details. A summary and discussion of our concerns follows.

Laboratory Setup

Code B's assessment did not include sufficient costs for constructing a \$590,000 simulator at ARC for systems development that is only needed because the consolidation will transfer the UH-60 helicopter to DFRC.

In addition, the assessment did not take into account the need for a local area network (LAN) at DFRC for use by the employees

accompanying the transferred aircraft and the visiting researchers. ARC officials estimated this cost to be \$2.8 million.

Also, a potential \$990,000 may be required to recreate at DFRC the helicopter telemetry and radar acquisition capabilities currently associated with ARC's Western Aeronautical Test Range (WATR).

We could not resolve the issues of LAN, data communication lines, and WATR prior to the release of the report, and so costs for these items are not factored into our calculation of the payback period. See page 57 for further details.

Personnel Relocation

Code B's assessment overstated nonrecurring costs related to relocation and new hires by \$1.3 million, because it used budget forecast data instead of actual historical cost data. See page 23 for further details.

Added Travel

Code B's assessment underestimated additional travel by \$2 million (nonrecurring) and \$1.2 million (recurring), because it maintains that anticipated budget reductions will not allow these additional travel costs to materialize. See page 25 for further details. Without adequate travel funding, however, research programs may substantially be descoped or eliminated, contrary to the ZBR goal.

Aircraft Parts & Fuel

Code B's assessment overestimated recurring savings for transferring two T-38s from LaRC and ARC to JSC by \$805,000, because its estimate was based on parts and fuel costs associated with operating T-38 aircraft at JSC and not actual FY95 expenditures for operating the aircraft at LaRC and ARC. See page 27 for further details.

Also, Code B's assessment did not account for pilot proficiency and chase costs required when the T-38's are transferred to JSC. See page 59 for further details.

Facility Closings

Code B's assessment overestimated by \$654,662 annual savings from closing the hangars at affected NASA airfields. This occurred because Code B used a facilities study to estimate maintenance costs and DFRC utility rates, rather than the actual costs incurred at these facilities. See pages 29 and 61 for further details.

We allowed over \$1 million in savings for reduced facility costs at Moffett Federal Airfield and Wallops Flight Facility. However, these

savings will not be realized because of the Administrator's commitment to keep these facilities open. See pages 60 and 61 for further details.

Code B also overstated annual savings of \$1.6 million for closing a portion of WATR located at ARC. We question the savings because the total amount that was allocated for operation of the WATR facilities has not decreased. See Appendix III and page 29 for further details.

Lost Research

Lost research costs are the additional costs that will occur due to lost productivity arising from the geographic separation of the research aircraft from their science users. Code B has underestimated nonrecurring lost research costs by \$3.1 million and recurring by \$.1 million because it based its costs on input from the HQ Program Offices as opposed to from the Centers. While we agree that the cost of lost research is subjective, we believe that the Centers' estimates should carry more weight than given by Code B. Because of the difficulty in quantifying lost research, we conservatively decremented the Centers' estimates by 50 percent. This estimated monetary cost of lost research was not factored into our calculations. See page 31 for further details.

*We, we, we
I wonder if
Dr. Knoll would
approve - or
have we changed
size?*

Decommissioned Aircraft

Code B estimated \$21.8 million in savings could be achieved by decommissioning aircraft no longer having a programmatic need. These savings, however, are the result of programmatic decisions, not the aircraft consolidation proposal. The OIG agrees with Code B that the decommissioning of aircraft no longer having a programmatic need will produce cost savings and that NASA should immediately begin decommissioning these aircraft. See page 13 for further details.

RECOMMENDATIONS

1. NASA should reevaluate its decision to implement the current aircraft consolidation plan because it is not cost effective.
2. NASA should immediately decommission all aircraft no longer having a programmatic need to achieve an estimated \$21.8 million savings.

*No action
official
Gold*

RE NASA management's response to our report consisted of a revised assessment, dated June 28, 1996, prepared by the Chief Financial Officer (CFO). Therein, the CFO stated that NASA's latest

assessment is objective, accurate, and applies a reasonable level of conservatism to the estimates. Further, the CFO stated that the assessment more than adequately supports the decision of management to proceed with aircraft consolidation. NASA's response is included in its entirety at Appendix II.

In response to Recommendation 1, NASA reevaluated its cost assessment, but did not reevaluate the decision to consolidate aircraft. Instead, NASA management only restated its position that it believes adequate support exists to proceed with aircraft consolidation at DFRC. NASA concluded in its latest assessment that consolidation will result in nonrecurring costs of \$8 million, net annual recurring savings of \$4.5 million, and produce a payback period of 3 years, including the cost of money.

NASA did not specifically address Recommendation 2 in its response, but reiterated that programmatic decommissioning of aircraft would produce an estimated annual savings of \$21.8 million. We believe that NASA management intends to decommission aircraft as planned.

***OIG EVALUATION OF
MANAGEMENT'S
RESPONSE***

The NASA management comments were not fully responsive to meet the intent of Recommendation 1. Since management did not reevaluate the decision to consolidate aircraft, we request a reconsideration by management of Recommendation 1.

We believe that NASA management intends to decommission aircraft as planned. However, we did not receive any specific information in the management comments on any existing decommission plans, such as timeframes for each aircraft to be decommissioned. We will followup and request further details on planned dates and actions to be taken to accomplish the decommissioning.

Subsequent to the release of our draft report to management for official comment, NASA provided considerable additional information and revised many of its previous cost estimates. Although the data evidenced further insight and analysis by NASA management, we still believe that the consolidation assumptions are optimistic and consolidation is not justified on the basis of cost savings. See Appendix III for a discussion of our concerns.

The greatest potential effect from consolidation will be the adverse impact on the efficiency, quality, effectiveness, and/or timeliness of

research efforts resulting from the separation of the aircraft from the center research capabilities. See Appendix III for examples of adverse programmatic impacts.

INTRODUCTION

The Office of Inspector General (OIG) has completed an audit of NASA's plan to consolidate research and program support aircraft at the Dryden Flight Research Center (DFRC). These aircraft are involved with airborne science programs and are "flying laboratories" that carry experiment instruments and researchers. The consolidation plan was based on consolidating 21 aircraft at DFRC, decommissioning 13 aircraft, and disposing or storing of 7 other aircraft. (see Exhibit II).

This is our final report or memorandum on the consolidation initiative. See Appendix I for a chronology of consolidation events.

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

Our audit objective was to determine the reasonableness of the assumptions underlying NASA's consolidation plan and the accuracy of Code B's cost assessments.

SCOPE AND METHODOLOGY

During this audit we reviewed Code B's assessments, including supporting analyses and documents. We conducted interviews with various NASA and contractor personnel and observed NASA aircraft and facilities during field site visits.

Specifically, we reviewed Code B's December 13, 1995 draft assessment, its February 8, 1996 and March 15, 1996 assessments as well as the applicable supporting data. Our results in this report are limited to the basic assumptions underlying the March 15, 1996 assessment (see Exhibit I). We reviewed 8 of the 15 cost elements identified in Code B's assessment which accounted for approximately 85 percent of the nonrecurring costs and 80 percent of the net recurring savings.

In addition, we conducted interviews with officials from NASA HQ Codes B, R, Y, the Office of Management Systems and Facilities and the Office of Space Science; officials and contractors from Ames Research Center (ARC), DFRC, LaRC, Lewis Research Center (LeRC), Johnson Space Center (JSC), and Wallops Flight Facility (WFF) aircraft operations; and selected NASA research scientists and

operations personnel. We also made site observations of aircraft operations at each affected Center.

We did not re-address Code B's suggested alternative plan to the DFRC consolidation plan which we reported in our March 8, 1996 memorandum. The alternative plan was to keep five aircraft at their current LeRC, LaRC, and WFF bases. NASA officials stated that they prefer full consolidation at DFRC and no longer consider this to be an alternative.

***MANAGEMENT CONTROLS
REVIEWED***

The need to test management controls depends on their relevance to the audit objective. We did not consider a review of management controls relevant to the audit objective.

AUDIT FIELD WORK

Our audit was conducted between July 1995 and August 1996, and was performed at ARC, DFRC, LeRC, LaRC, WFF, and NASA HQ. As part of this audit, we issued two prior reports on the aircraft consolidation decision: a letter dated March 8, 1996; and a rapid action audit report (HA-96-001) dated December 7, 1995. The audit was performed in accordance with generally accepted government auditing standards.

CONCLUSION

Our review found that many of the assumptions underlying Code B's assessment of the savings from consolidating aircraft at DFRC are optimistic. In addition, the costs of consolidation are greater than Code B's estimates. As a result, we believe that the proposed consolidation of aircraft is not cost effective and will have adverse programmatic affects.

While our analysis focused primarily on the costs and savings that would occur from the consolidation of aircraft, we did review the logistical feasibility of such a consolidation. We observed firsthand the hangar facilities at DFRC and believe they are adequate for housing the transferred aircraft. DFRC also has sufficient office space to support the additional 290 employees that will accompany the transferred aircraft. To this end, we believe DFRC can perform the operation and maintenance functions necessary to support the transferred aircraft.

OBSERVATIONS AND RECOMMENDATIONS

OVERALL EVALUATION

The following evaluation pertains to our June 4, 1996 draft audit report. Information provided by NASA subsequent to this draft report as well as information contained in management's June 28, 1996 response is addressed in our Evaluation of Management's Response (see Appendix III).

Expected cost savings were cited as the primary reason for NASA's decision to consolidate aircraft. However, based on our evaluation of the facts and assumptions related to NASA's aircraft consolidation plan, including Code B's assessment of consolidation costs, we conclude that the proposed consolidation of research and support aircraft at DFRC is not cost effective. We found that many of Code B's assumptions and cost savings projections were optimistic, and many of its cost estimates did not adequately reflect actual cost history. Code B's March 15, 1996 assessment identified nonrecurring (one-time) costs of \$10.0 million and annual savings of \$4.5 million, resulting in a payback period of 2.2 years. This assessment is based on consolidating 21 aircraft at DFRC, decommissioning 13 aircraft, and disposing or storing of 7 other aircraft (See Exhibit II).

The OIG adjusted the payback period stated in our June draft from 72 years to 52 years to account for items contained in both nonrecurring and recurring additional travel which we also included in other cost categories. Accordingly, based on NASA's current consolidation plan, we estimate nonrecurring, initial investment costs will be \$11.3 million with net annual recurring savings of \$218,049. If the cost of money (discount rate) is factored in, we project that NASA would never recover its financial investment.

Several key factors should be considered in evaluating the cost effectiveness of the proposed aircraft consolidation. Specifically, readily measurable savings occur when personnel levels and infrastructure costs are reduced. Code B's assessment reveals that of the 503 employee positions associated with the aircraft consolidation, only 23 will be eliminated as the result of consolidation. The decommissioning, storage and disposal of aircraft will eliminate 190 positions (See Exhibit III). Consequently, significant personnel savings result from programmatic decisions to decommission, store, or dispose of aircraft rather than from consolidation.

Some Centers impacted by consolidation have stated they intend to reassign employees into other positions, rather than dismissing them once the aircraft are transferred to DFRC. For example, LeRC civil service employees working on aircraft have been reassigned to positions in other offices and are currently detailed back into their positions to work on aircraft.

NASA management has also indicated that consolidation is necessary to reduce infrastructure costs at the four Centers losing aircraft. However, all Centers have indicated that their facilities will not be closed to the extent that NASA stated consolidation will achieve. Conversely, the fact that NASA has made a commitment to maintain the operation of Moffett Federal Airfield at ARC for the foreseeable future means annual costs of \$3.0 million will continue. These have not been factored into the cost of consolidation by either Code B or the OIG.

A summary of our concerns follows:

***Laboratory Setup
(Schedule A)***

Code B's assessment included \$900,000 for laboratory setup costs. However, Code B did not include sufficient costs for a Local Area Network (LAN) at DFRC for use by the 290 employees accompanying the transferred aircraft or the visiting scientists and researchers. A LAN is an essential requirement for the continuity of research and researchers' productivity.

Furthermore, the assessment did not include costs for installing a supplemental data communication line between DFRC and ARC to maintain current interfacing capabilities. ARC officials estimate that \$2.8 million will be necessary to setup and install data communication lines for 230 terminals and computers at DFRC. DFRC officials contend that they have not been informed of any specific requirements and object to any costing by the OIG for the laboratory setup. Although we could not resolve this issue prior to the release of this report, we believe it is important to highlight the potential expense.

In addition, no costs were included for constructing a \$590,000 simulator at ARC for systems development on the UH-60 helicopter used for the Rotorcraft/Aircrew Systems Concepts Airborne Laboratory (RASCAL) program. Researchers at ARC were going to use the actual helicopter in simulation mode to perform RASCAL systems development. However, since the researchers are not transferring to DFRC along with the RASCAL helicopter, they will need to use a simulator 30 hours a week to perform the required

software development. The \$590,000 simulator will not be necessary if the RASCAL helicopter remains at ARC.

***Personnel Relocation
and New Hires Expenses
(Schedule B)***

NASA's consolidation plans varied considerably as to the number and type of aircraft to be transferred and the number of employees needed to support the operation and maintenance of those aircraft. Initially, the plan was to transfer 22 aircraft and 320 personnel to DFRC. This later changed to 17 aircraft and 254 personnel. The current plan calls for 21 aircraft and 290 personnel (150 civil service employees and 140 contractor staff).

These figures remain in flux. For example, the status of the C-141 aircraft at ARC is uncertain. Code B's assessment was premised on this aircraft being sent to DFRC for storage and maintained in flyable condition. However, NASA has indicated that the aircraft could be used as government-furnished equipment to the winning bidder on the Stratospheric Observatory for Infrared Astronomy project.

If the C-141 aircraft is not taken out of service, the status of another 35 civil service and 48 support contractor personnel (an additional 29 percent above the planned 290) must be reevaluated. As a result, personnel relocation, new hires, and training costs may increase and Code B's estimated savings due to decommissioning will correspondingly decrease by \$8.8 million to \$13.0 million annually.

In addition, the OIG believes Code B overstated costs related to relocation and new hires by \$1.3 million. This amount represents the difference between Code B's assessment of \$6.9 million based on budget forecast data and the OIG's estimate of \$5.6 million based on actual FY 1995 cost data experienced for previous personnel relocations to DFRC.

***Added Travel
(Schedule C)***

Code B's assessment included \$.7 million in nonrecurring costs and \$2.1 million in recurring costs for additional travel associated primarily with relocating the B-757 aircraft to DFRC. The OIG believes these costs are underestimated based on information we received from the ARC, LaRC, LeRC, WFF. We estimated the added travel costs will be \$3.1 million nonrecurring and \$1.2 million recurring. The OIG's estimate of nonrecurring, added travel is primarily based on LaRC's B-757 and LeRC's DC-9 aircraft. These same two aircraft account for the majority of the OIG's estimate of recurring, added travel costs. Code B maintained that due to anticipated budget reductions, the program offices will not be able to fund these additional travel costs and, therefore, these costs should not

materialize. Without this travel, however, the potential exists for schedule slippage and/or reduced levels of research being performed.

Following the issuance of this draft, we adjusted travel costs which we included in other cost categories. Thus, the amount for added travel costs should be \$2,684,700 (nonrecurring) and \$3,264,100 (recurring).

***Aircraft Parts and Fuel
(Schedule D)***

Code B's assessment claimed annual recurring parts and fuel savings of \$1.25 million. The majority of Code B's projected savings is associated with two T-38 aircraft located at LaRC and ARC. Code B estimated that by relocating these aircraft to JSC and taking two comparable aircraft out of service, NASA could save \$1.2 million (\$600,000 per aircraft). Our estimated savings (\$395,000 for both aircraft) more closely represent the costs based on actual usage of the ARC and LaRC aircraft.

Code B based its estimate on the parts and fuel costs associated with operating existing T-38 aircraft at JSC and not on actual expenditures for operating the aircraft at LaRC and ARC. The T-38 aircraft at JSC fly an average of 335 hours per year. The T-38's at LaRC and ARC fly far fewer hours, 94 and 127 respectively. Because operating costs for these aircraft directly relate to the number of hours flown, we believe that Code B has overestimated the savings from the transfer of the two aircraft.

***Facility Closings
(Schedule E)***

Code B's assessment estimated \$3.9 million annual savings from closing facilities at various NASA airfields. The OIG questions \$2.3 million of this amount. The OIG questions \$.7 million in savings because Code B used a June 1994 NASA-wide facilities study to estimate maintenance costs and DFRC utility rates to estimate facilities costs at LeRC, LaRC, and ARC, rather than the actual costs being incurred at these facilities.

Also, the assessment included \$1.6 million as savings for closing a portion of the Western Aeronautical Test Range (WATR) located at ARC. The OIG questions the entire \$1.6 million savings included in Code B's assessment because the total amount that was allocated for operation of the WATR facilities has not decreased. DFRC officials confirmed that they have customer requirements for the WATR capability that extend to FY 1999, and that they will provide the service currently provided by ARC. See Appendix III, "*Facility Closings*".

***Lost Research
(Schedule F)***

Lost research costs are the additional costs that will occur due to lost productivity arising from the geographic separation of the research aircraft from their science users. Code B has estimated that there will be no nonrecurring costs of lost research and about \$300,000 in recurring costs. Code B based its estimates on input from the Centers together with additional input from the Headquarters Program Offices. Initial estimates of costs from the Centers were reduced or eliminated by Code B based on the assumption that costs would be minimal due to timely reassignment of researchers to other programs.

While we agree with Code B's position that the cost of lost research is subjective, we believe that the estimates from the Centers should carry more weight than given by Code B. The Centers have extensive experience in operating and maintaining aircraft in the conduct of research. The four affected Centers estimated the nonrecurring cost of lost research at about \$ 6.3 million and the recurring cost at \$834,000. Because it is difficult to quantify lost research, we conservatively decremented the Centers' estimates by 50 percent. This resulted in an additional \$3.1 million in nonrecurring costs and \$.1 million in recurring costs.

We did not factor this estimated monetary cost of lost research into our calculations of the proposed airplane consolidation. However, it is a factor that Code B should have developed further, and one we have chosen to present below the line in our cost assessment.

***Decommissioning
Aircraft***

Code B's assessment identified personnel reductions that will occur as the result of both decommissioning aircraft and aircraft consolidation. In total, Code B identified 190 positions that will be reduced due to the decommissioning of 13 aircraft and disposing or storing of 7 other aircraft. These savings, however, are the result of programmatic decisions, not the airplane consolidation proposal.

The OIG agrees with Code B that the decommissioning of aircraft will produce real cost savings to NASA. In this regard, Code B estimated \$21.8 million in savings could be achieved by decommissioning aircraft no longer having a programmatic need. We believe NASA should immediately begin decommissioning these aircraft to achieve maximum cost savings.

***OVERALL
CONCLUSION***

We have analyzed NASA's cost estimates to consolidate research and program support aircraft at DFRC, interviewed key officials, and made site observations of aircraft operations at each affected Center. In our opinion, many of the assumptions underlying Code B's assessment of the savings from consolidating aircraft at DFRC are optimistic. We

also believe the costs of consolidation are greater than Code B's estimates. As a result, we believe that the proposed consolidation of aircraft is not cost effective.

While our analysis focused primarily on the costs and savings that would occur from the consolidation of aircraft, we did review the logistical feasibility of such a consolidation. We observed firsthand the hangar facilities at DFRC and believe they are adequate for housing the transferred aircraft. DFRC also has sufficient office space to support the additional 290 employees that will accompany the transferred aircraft. To this end, we believe DFRC can perform the operation and maintenance functions necessary to support the transferred aircraft.

RECOMMENDATION 1

NASA should reevaluate its decision to implement the current aircraft consolidation plan because it is not cost effective.

RECOMMENDATION 2

NASA should immediately decommission all aircraft no longer having a programmatic need to achieve an estimated \$21.8 million savings.

***MANAGEMENT'S
RESPONSE***

In response to the OIG's draft audit report of June 4, 1996, NASA management restated its position that adequate support exists to proceed with aircraft consolidation at DFRC. That response reiterated the assumptions presented in Code B's assessment. It presented a revised assessment that concluded that consolidation will result in nonrecurring costs of \$8 million, net annual recurring savings of \$4.5 million, and produce a payback period of 3 years, factoring in the cost of money. The assessment also concluded that programmatic decommissioning of aircraft would produce an estimated annual savings of \$21.8 million. See Appendix II for a copy of NASA management's response in its entirety.

***OIG'S EVALUATION
OF MANAGEMENT'S
RESPONSE***

Subsequent to the issuance of our draft report, NASA management, the HQ program offices, and affected field Centers provided additional information to the OIG. The data provided further insight and promoted additional analysis, but our conclusions remain unchanged - that NASA's consolidation assumptions are overly optimistic and that consolidation of aircraft cannot be justified on the basis of cost savings.

The OIG adjusted the payback period stated in our June draft from 72 years to 52 years to account for items contained in both nonrecurring and recurring additional travel which we also included in other cost categories. Accordingly, based on NASA's current consolidation plan,

we estimate nonrecurring, initial investment costs will be \$11.3 million with net annual recurring savings of \$218,049. If the cost of money (discount rate) is factored in, we project that NASA would never recover its financial investment. In addition, there are numerous other cost issues and program impacts that we discuss in Appendix III, which further support our conclusion that consolidation cannot be justified on a cost savings basis.

In terms of our audit recommendations, NASA has reevaluated its assessment. However, NASA has not assessed the fundamental impacts to the Agency's research programs by dismantling established research facilities at ARC, LaRC, LeRC, and WFF and recreating these capabilities at DFRC. NASA has approached consolidation simply as the relocation of aircraft and ignored the decades of synergies built up between science researchers, aircraft, and institutional assets.

Regarding Recommendation 2, since Code B's revised assessment reiterates the cost savings due to programmatic decommissioning of aircraft, we infer the intent of management to comply with this recommendation. Thus, the OIG considers NASA planned actions to be responsive. We did not evaluate the accuracy of the \$21.8 million savings associated with decommissioned aircraft. However, we do support the decommissioning of any aircraft no longer having a programmatic need, and believe that decommissioning aircraft will result in significant cost savings to NASA.

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DETAILED RESULTS OF REVIEW

<u>COST ELEMENT</u>	<u>CODE B ASSESSMENT</u>	<u>OIG COST ADJUSTMENT (a)</u>	<u>ADJUSTED TOTALS</u>	<u>NOTES/ REFERENCE</u>
NONRECURRING COST:				
A/C Ferry, Fuel & Parts	\$ 111,743		\$ 111,743	
Ground Support Equipment Transfer	122,000		122,000	
Laboratory Setup	900,000	\$ 590,000	1,490,000	Note 1/Sch. A
Paperwork & Records	205,000		205,000	
Personnel Relocation	6,561,951	(1,271,951)	5,290,000	Note 2/Sch. B
Personnel New Hires	364,768	(59,168)	305,600	Note 2/Sch. B
Personnel Training	1,041,060		1,041,060	
Facility Shutdown	30,000		30,000	
Cost of Added Travel	<u>662,156</u>	<u>2,022,544 (b)</u>	<u>2,684,700 (b)</u>	Note 3/Sch. C
TOTAL Nonrecurring Cost	<u>\$9,998,678</u>	<u>\$1,281,425 (b)</u>	<u>\$11,280,103 (b)</u>	
RECURRING ANNUAL SAVINGS:				
Annual Savings:				
Personnel from A/C Decommissioning	\$ 763,108		\$ 763,108	
Decommissioned A/C Parts & Fuel	1,245,676	\$(805,000)	440,676	Note 4/Sch. D
Due to Synergism of Personnel at DFRC	1,291,214		1,291,214	
Due to Facility Closing	<u>3,926,748</u>	<u>(2,254,662)</u>	<u>1,672,086</u>	Note 5/Sch. E
TOTAL Annual Savings (a)	<u>\$7,226,746</u>	<u>\$(3,059,662)</u>	<u>\$4,167,084</u>	
Annual Added Costs:				
Out-of-pocket (travel, shipping, etc.)	\$ 2,083,479	\$ 1,180,621 (b)	\$3,264,100 (b)	Note 3/Sch. C
DFRC Hanger Costs	<u>684,935</u>		<u>684,935</u>	
TOTAL Annual Added Costs (b)	<u>\$ 2,768,414</u>	<u>\$ 1,180,621 (b)</u>	<u>\$ 3,949,035 (b)</u>	
Net Recurring Savings (a-b)	<u>\$4,458,332</u>		<u>\$ 218,049 (b)</u>	
Pay Back Period	2.24 years		51.73 years (b)	
Pay Back Period w/cost of money	3 years		Infinity (c)	
IDENTIFIED OPPORTUNITY COSTS				
Nonrecurring Lost Research	\$ -0-	\$ 3,145,329	\$3,145,329	Note 6/Sch. F
Recurring Cost of Lost Research	\$ 303,467	\$ 113,533	\$ 417,000	Note 6/Sch. F
Recurring Moffett Airfield Costs	\$ -0-	\$ 3,000,000	\$3,000,000	Note 7
Annual Savings due to Aircraft Decommissioning	\$21,797,136		\$21,797,136	

- (a) Not all cost elements were reviewed. Selected cost elements were reviewed based on materiality and cost impact.
- (b) After we issued our draft report on June 4, 1996, we adjusted additional travel costs for amounts which were also included in other cost categories.
- (c) Estimated payback period considering the cost of money factor, based on an interest rate of 6.56 percent, which was the 10 year Treasury Note rate as of August 8, 1996; we did not factor in the cost of money in our June 4, 1996, draft report.

Explanatory Notes:

1. **Laboratory Setup.** While Code B's assessment included \$900,000 for laboratory setup costs, it did not include any costs for constructing a test and development bed (simulator) at ARC for the UH-60 RASCAL helicopter. Prior to consolidation, researchers at ARC had planned to accomplish RASCAL systems development using the actual helicopter in a simulation mode. Because the researchers are not transferring to DFRC along with the helicopter, there is now a requirement for a simulator at ARC so that RASCAL systems development can continue. ARC estimated the costs for the simulator would total \$590,000 and would not be necessary if the helicopter remained at ARC.

In addition, Code B has not included sufficient costs for a LAN for use at DFRC by the 290 employees accompanying the transferred aircraft as well as by visiting program scientists and researchers. Furthermore, no costs were included for installing a supplemental data communication line between DFRC and ARC to maintain current interfacing capabilities. ARC officials estimate that \$2.8 million will be necessary to setup and install data communication lines for the terminals and computers at DFRC. We believe the LAN and the data communication line are essential for the continuity of research and researchers' productivity. However, because these requirements have not yet been defined, we were not able to estimate these costs. (See Schedule A for details.)

2. **Personnel Relocation and New Hires Expenses.**

- (a) **Code B Assumptions.** Code B's assessment was based upon 290 employees (150 civil service and 140 support service contractor employees) being staffed at DFRC to operate and maintain the transferred aircraft. Of the 150 civil service positions moving to DFRC, 70 will be relocated civil service personnel and 80 will be new hires. Of the new hires, 80 percent (64 positions) will be hired locally. Of the 140 support service employee positions, NASA maintained that it will only fund relocations for 50 positions while filling the remaining 90 positions from the local DFRC job market. NASA firmly stated that there will be no funds available to reimburse contractors for relocating any employees over the 50 positions. Based on results of our review and interviews conducted at DFRC, the OIG accepted Code B's assumptions regarding personnel staffing as reasonable.
- (b) **Civil Service Relocation.** Code B estimated civil service relocation will cost \$4.6 million for 70 civil service employees. The OIG estimated that only \$3.3 million will be expended for personnel relocation. The difference of \$1.3 million was due primarily to Code B's use of budget forecast data versus OIG use of FY 1995 actual cost information for permanent change of station (PCS), guaranteed home sales (GHS), and household goods (HHG) shipment expenses to relocate to DFRC.
- (c) **Support Service Employee Relocation.** Code B's assessment allowed a total of \$2.0 million for the relocation of only 50 contractor employees (\$40,000 each) associated with critical skills needed at DFRC. Code B estimated that the local DFRC job market could provide

NASA contractors with a large pool from which to hire the remaining 90 positions. Based upon our inquiries of the local labor market, the estimate was accepted as proposed.

- (d) New Hires. Code B estimated new hires expenses as \$364,768 based upon budget forecast data. The OIG used FY 1995 cost information for PCS and HHG shipment expenses for new hires at DFRC to arrive at \$305,600, a difference of \$59,168. (See Schedule B for details.)

3. **Added Travel.** Code B's estimated \$.7 million (nonrecurring) and \$2.1 million (recurring) for the cost of additional travel that will occur primarily with the relocation of the B-757 and DC-9 aircraft to DFRC. After we issued our draft report on June 4, 1996, we adjusted additional travel costs for amounts which were also included in other cost categories. The OIG believes Code B underestimated these travel costs and that an additional \$2 million (nonrecurring) and \$1.2 million (recurring) will be incurred. OIG estimates are based upon input received from ARC, LaRC, LeRC, and WFF. Not all aircraft or science programs are equally affected. For example, travel costs on two WFF programs will actually decrease once the planes relocate to DFRC. However, the overall impact on WFF programs will be a 41 percent increase in program travel costs. Code B maintained that due to budget reductions, the program offices will not be able to fund these additional travel costs; therefore, they will not be realized. (See Schedule C for details.)
4. **Aircraft Parts and Fuel.** Code B's assessment included \$1.25 million for savings associated with aircraft parts and fuel. Of this amount, \$1.2 million was associated with two T-38 aircraft currently based at ARC and LaRC (\$600,000 each). The savings are based on T-38's located at JSC which experience approximately three times the flight activity of the aircraft at ARC and LaRC. The OIG estimated that \$395,000 more closely approximated the operating cost for these aircraft and questioned \$805,000 of Code B's annual savings estimate. The ARC and LaRC T-38's will transfer to JSC to be incorporated into its fleet of 31 T-38 aircraft enabling two "high mileage" T-38's to be taken out of service and cannibalized for parts. (See Schedule D for details.)
5. **Facility Closings.** Code B estimated savings from closing facilities at various NASA airfields will be \$3.9 million annually. Of this amount, \$1.6 million was for closing the WATR located at ARC. The OIG questions the entire \$1.6 million savings included in Code B's assessment because the total amount that was allocated for operation of the WATR facilities was not decreased. The OIG questioned an additional \$.7 million of the \$2.3 million remaining in facilities savings because Code B used a 1994 study to estimate costs for facilities operations at LeRC, LaRC, ARC and WFF, rather than the actual costs incurred for these facilities. The study attempts to define the minimum spending requirements to sustain center facilities, without degradation, at a consistent level of readiness and effectiveness. However, we consider the study to be theoretical as actual expenditures have shown that NASA has never funded to that level. (See Schedule E for details.)
6. **Lost Research.** Code B's assessment made no allowance for nonrecurring costs attributable to lost research, but did provide \$.3 million for the recurring cost of lost research (classified as "Opportunity Costs"). Lost research, as defined by Code B, was the cost of lost productivity associated with the geographic separation of the aircraft from the research scientists. Not all

aircraft or science programs are equally affected. For some research programs, it is of no consequence if the aircraft are not collocated with the research teams. For others, collocation is essential for maximum efficiency.

Code B and the OIG agreed that the cost of lost research was not conducive to precise measurement. For this reason, we set aside this cost of consolidation and evaluated it separately. This contrasted with our previous reviews that evaluated it along with other recurring and nonrecurring costs. In a further attempt to conservatively review this cost, we judgmentally applied a 50 percent decrement factor to the impact assessments that we obtained from researchers and scientists to more reasonably approximate the costs of lost research on the B-757 aircraft program. With this, we determined that \$3.1 million of (nonrecurring) costs due to lost research could be reasonably expected. OIG analysis of (recurring) lost research costs is based upon analysis of input received from ARC, LaRC and LeRC. Based upon this input we determined that an additional \$.1 million (recurring) cost should be included in Code B's assessment. (See Schedule F for details.)

- 7. Moffett Federal Airfield.** NASA's cost to operate Moffett Federal Airfield is approximately \$5.0 million annually. Other federal tenants reimburse NASA \$2.0 million, thus \$3.0 million remains as NASA's cost. Because of the Administrator's recent decision to retain operational responsibility for Moffett, the \$3.0 million annual operating cost actually continues as an expense after aircraft consolidation at DFRC.

SCHEDULE A

OIG ANALYSIS OF LABORATORY SETUP COSTS

<u>Center</u>	<u>Code B</u> <u>Assessment</u>	<u>Note</u>	<u>OIG</u> <u>Cost Adjustment</u>	<u>Note</u>	<u>OIG</u> <u>Adjusted Total</u>
ARC	\$ 400,000	1	\$ 590,000	2	\$ 990,000
LaRC	<u>500,000</u>	1	<u>-0-</u>		<u>500,000</u>
Total	<u>\$ 900,000</u>		<u>\$ 590,000</u>	3	<u>\$1,490,000</u>

Explanatory Notes:

1. Code B's assessment of aircraft consolidation costs at DFRC included \$900,000 for laboratory setup costs. Of this amount, \$400,000 was for laboratory costs associated with three ARC aircraft (two ER-2's and one DC-8) and \$500,000 was for costs associated with one B-757 aircraft at LaRC. These costs were based upon a review of the Centers' detailed cost estimates, which included setup of test facilities, integration areas, and other laboratories at DFRC. Code B adjusted these estimates based upon input received from HQ program officials (Codes R and Y) and DFRC personnel. The input provided by the program officials was based upon the future budget reductions anticipated by the Codes.
2. Prior to consolidation, researchers at ARC had planned to develop the RASCAL system using the actual helicopter in a simulation mode for approximately 30 hours a week. Because the researchers will not be transferred to DFRC along with the RASCAL helicopter, there is now a requirement to construct a test and development bed at ARC so that systems development research on the RASCAL can continue. ARC estimated, based upon historical experience of internal fabrication and manufacturers' pricing, that the test and development bed (\$170,000) will need a flight control computer (\$210,000) and a servo emulator unit (\$210,000) for a total of \$590,000. This test and development bed would not be necessary if the helicopter remained at ARC.
3. Code B did not include sufficient costs for establishing a LAN for use at DFRC by 290 employees accompanying the transferred aircraft, as well as by the visiting program scientists and researchers. The hangar where the aircraft are to be consolidated is not connected to DFRC's LAN. Thus, there will be additional costs to wire the hangar to DFRC and to set up multiple workstations in the hangar. Potential users from the affected Centers have not identified their LAN system requirements to DFRC. Possible costs would include LAN installation, operation support, equipment, and user training.

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**OIG ANALYSIS OF PERSONNEL
RELOCATION & NEW HIRES EXPENSES**

<u>Cost Element</u>	Code B		OIG		OIG
	<u>Assessment</u>	<u>Note</u>	<u>Cost Adjustment</u>	<u>Note</u>	<u>Adjusted Total</u>
Personnel Relocation	\$6,561,951	1	(\$1,271,951)	2	\$5,290,000
New Hires	364,768	1	(59,168)	3	305,600

Explanatory Notes:

- Code B's assessment was based upon 290 employees (150 civil service and 140 support service contractor employees) being staffed at DFRC to operate and maintain the transferred aircraft. Of the 150 civil service positions moving to DFRC, 70 will be relocated civil service personnel and 80 will be new hires. Of the 80 new hires, 80 percent (64 positions) will be hired locally. Of the 140 support service employee positions, NASA management indicated that it will only fund relocations for 50 positions while filling the remaining 90 positions from the local DFRC job market. NASA firmly stated that there would be no funds available to reimburse contractors for relocating more than 50 employees. The OIG accepted Code B's assumptions regarding personnel staffing as reasonable as they relate to these aircraft.

Code B's estimate was based upon costs associated with relocating existing personnel and hiring new staff as follows:

Personnel Relocation Costs. Code B's assessment included \$6.6 million in relocation costs, which consisted of \$4.6 million for relocating an equivalent of 65.2 civil service employees at \$70,000 per person, and \$2.0 million for the relocation of 50 contractor employees at \$40,000 per person. These estimates were based on budget forecast data which took into consideration actual historical cost.

New Hires Costs. Code B's assessment of \$364,768 for new hires expenses was based upon budget forecast data.

- The OIG estimated personnel relocation costs are as follows:

Civil Service Employees (see Note a)	\$3,290,000
Support Service Employees (see Note b)	<u>2,000,000</u>
Total Personnel Relocation Costs	<u>\$5,290,000</u>

- (a) Civil Service Relocation. We estimated relocation costs at \$47,000 per employee, for a total of \$3,290,000. The \$47,000 rate was composed of two rates based upon actual relocation costs experienced by DFRC in FY 1995. Our two assumptions (based on the FY 1995 data) were: (1) half (35) of the 70 civil service personnel relocations will involve GHS and the other half will not; and (2) all 70 employees will receive temporary quarters, new home purchase and HHG shipment costs. GHS costs per person averaged \$31,000 in FY 1995. Temporary quarters and HHG shipment costs averaged \$31,500 per person bringing the total to:

$$\begin{array}{r}
 (\$31,000 + \$31,500) \times 35 = \$2,187,500 \\
 \$31,500 \times 35 = \underline{\$1,102,500} \\
 \text{Total} \qquad \qquad \qquad \underline{\underline{\$3,290,000}}
 \end{array}$$

Accordingly, we believe Code B overstated personnel relocation costs by \$1,271,951 (\$4,561,951 - \$3,290,000).

- (b) Contractor Relocation. Code B maintained that NASA will pay only \$2.0 million for 50 contractor employees associated with critical skills needed at DFRC. Code B stated that a firm commitment exists to only pay the relocation expenses for these 50 contractor employees. Any relocation costs that exceed this amount would be paid by the contractor at no cost to the government. Code B estimated that the local DFRC job market will provide NASA contractors with a large pool from which to hire the other 90 employees with the necessary skills to achieve the remaining staffing complement. We accepted Code B's assumption. Based on our inquiries of the local labor market, the estimate was accepted as proposed.

3. Of the 80 new hires, Code B estimated that 80 percent, or 64 positions, will be hired from the community around DFRC at no cost to NASA. Code B's assumption that 80 percent of new hires will be available locally at DFRC appeared reasonable based upon our review of the current local job market. The remaining 20 percent (16 positions) will incur relocation costs of \$19,100 each, which represented the actual cost experienced by new hires relocating to DFRC. Thus, new hires expense was calculated as follows:

$$(16 \text{ positions} \times \$19,100) = \$305,600$$

Accordingly, we believe Code B overstated new hire costs by \$59,168 (\$364,768 - \$305,600).

**OIG ANALYSIS OF NONRECURRING /RECURRING TRAVEL COSTS
(Including Ferry or Commercial Air, Per Diem, Car Rental)**

<u>Travel Costs *</u>	Code B		OIG		OIG
	<u>Assessment</u>	<u>Note</u>	<u>Cost Adjustment</u>	<u>Note</u>	<u>Adjusted Total</u>
Nonrecurring	\$ 662,156	1	\$2,022,544	2	\$2,684,700
Recurring	2,083,479	1	1,180,621	2	3,264,100

* Travel costs represent the additional costs that will be incurred by researchers and scientists who must travel to DFRC to conduct their research, rather than to the Center where the aircraft are currently based.

Subsequent to the issuance of the draft, we adjusted additional travel costs for amounts which were also included in other cost categories. See explanatory note 2 for more details.

Explanatory Notes:

- Code B's assessment was based upon their review of the other Centers' detailed cost estimates for ferry or commercial air, per diem, car rental, hangar costs, and shipping costs associated with consolidating aircraft at DFRC. Code B adjusted these estimates based upon input received from HQ program officials (Codes R and Y) and DFRC personnel. The input provided by the program officials was based upon the future budget reductions anticipated by the Codes.
- The OIG believes that Code B underestimated the additional travel costs that will occur after consolidation. The OIG's own assessment of nonrecurring/recurring travel costs was based upon data received from ARC, LaRC, LeRC, and WFF. The OIG considered the ARC, LaRC, LeRC, and WFF estimates for added travel costs to be more accurate than Code B's. These Centers have had many years of experience in operating and maintaining their specific research programs, such as the B-757 aircraft program at LaRC and, therefore, are more knowledgeable of the science requirements.

The OIG also recognized that not all aircraft or science programs will be equally affected. For example, at WFF, the travel cost impact on 2 of 18 programs will actually decrease when the aircraft are moved to DFRC. The remaining 16 programs will incur additional travel costs. Overall, the 18 WFF programs will experience a 41 percent increase in travel costs when aircraft are consolidated at DFRC. The estimates provided by the individual Centers were used in the calculations that follow.

The travel costs for both nonrecurring and recurring travel costs have been adjusted in this final report. The calculations we used for our June 4, 1996 draft report and our August 12, 1996 final report are:

<u>Nonrecurring Cost:</u>	<u>TOTAL TRAVEL PER CENTER</u>	
	<u>Draft (6/4/96)</u>	<u>Final (8/12/96)</u>
ARC	9,500	\$ 0
LaRC	2,684,700	2,684,700
LeRC	<u>1,113,000</u>	<u>0</u>
Total Nonrecurring Travel Costs	<u>\$3,807,200</u>	<u>\$2,684,700</u>

LaRC's estimate of \$2,684,700 additional nonrecurring travel was associated entirely with the B-757 aircraft. Travel associated with the DC-9 represented \$868,000 of LeRC's \$1,113,000 estimate used in our June 4, 1996 draft report.

<u>Recurring Cost:</u>	<u>TOTAL TRAVEL PER CENTER</u>	
	<u>Draft (6/4/96)</u>	<u>Final (8/12/96)</u>
ARC	\$ 310,500	\$ 310,500
LaRC	824,000	824,000
LeRC	1,547,000	1,502,000
WFF	<u>627,600</u>	<u>627,600</u>
Total Recurring Travel Costs	<u>\$3,309,100</u>	<u>\$3,264,100</u>

In our June 4, 1996 draft report, LeRC's estimate of \$1,547,000 additional recurring travel was associated with the DC-9 (\$1,417,000) and DHC-6 (\$130,000) aircraft. This final report has been adjusted to reflect the correct LeRC estimate to \$1,502,000 associated with the DC-9 (\$1,372,000) and DHC-6 (\$130,000). Not all Center science programs that utilize aircraft evaluated the costs of additional travel that will occur due to transfer of the aircraft to DFRC.

SCHEDULE D

OIG ANALYSIS OF AIRCRAFT PARTS & FUEL

<u>AIRCRAFT</u>	<u>CODE B ASSESSMENT</u>	<u>NOTES</u>	<u>OIG COST ADJUSTMENT</u>	<u>OIG ADJUSTED TOTAL</u>	<u>NOTES</u>
T-38A	\$ 600,000	1	(\$373,000)	\$ 227,000	2
T-38A	600,000	1	(432,000)	168,000	3
T-34B	13,505		--	13,505	
OV-10A	<u>32,171</u>		<u>--</u>	<u>32,171</u>	
Totals	<u>\$1,245,676</u>		<u>(\$805,000)</u>	<u>\$ 440,676</u>	

Explanatory Notes:

1. Code B's estimate of claimed savings represented the average annual operating cost for T-38 aircraft based at JSC, which fly an average of 335 hours per year (FYs 1994-1995 data). Because maintenance, inspections, and performance upgrades are functions of flight hours, we applied JSC's average cost (baseline) on a percentage basis for the T-38's located at ARC and LaRC.
2. ARC's T-38 flew an average of 127 hours annually based upon FYs 1994 - 1995 data. As applied to JSC's average cost, the ARC T-38 would be \$227,000 ($\$600,000 \times (127 \div 335)$). The OIG questioned the difference of \$373,000 [$\$600,000 - \$227,000$].
3. LaRC's T-38 flew an average of 94 hours annually based upon FYs 1993-1995 data. On a percentage basis, the LaRC T-38 average annual operating cost would be \$168,000 ($\$600,000 \times (94 \div 335)$). The OIG questioned the difference of \$432,000 [$\$600,000 - \$168,000$].

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OIG ANALYSIS OF FACILITIES ANNUAL SAVINGS

<u>COST ELEMENT</u>	<u>CODE B ASSESSMENT</u>	<u>NOTES</u>	<u>OIG COST ADJUSTMENT</u>	<u>OIG ADJUSTED TOTAL</u>	<u>NOTES</u>
ARC-Moffett Field					
Operations Costs	\$ 650,000			\$ 650,000	
ARC Facilities	532,505	1. a.	\$ (230,419)	302,086	1. b.
Net Savings WATR	<u>1,600,000</u>		<u>(1,600,000)</u>	<u>-0-</u>	2
Subtotals	\$2,782,505		\$ (1,830,419)	\$ 952,086	
LaRC - Facilities	\$ 396,032	1. a.	(187,032)	209,000	1. c.
LeRC - Facilities	388,211	1. a.	(278,211)	110,000	1. d.
WFF - Facilities	<u>360,000</u>		<u>41,000</u>	<u>401,000</u>	1. e.
Totals	<u>\$3,926,748</u>		<u>\$ (2,254,662)</u>	<u>\$1,672,086</u>	

Explanatory Notes:

1. a. Code B's Center facilities estimates were based upon a June 1994 study entitled "Sustaining the NASA Aeronautics Facilities: Funding Requirements for Preservation and Restoration." The study represented HQ estimates of cost for annual maintenance, repair work, and programmed maintenance at each Office of Aeronautics Center (ARC, DFRC, LaRC, and LeRC). Actual cost history for facilities maintenance for each of these Centers was not reflected. For FY 1994, actual expenditures were 29 percent below the level the study identified as minimum sustaining needs. Thus, we considered estimated maintenance costs based upon historical operating cost data at each Center to more reasonably reflect annual savings.

For utility costs, Code B used DFRC's utility rates of \$1.69 per square foot and applied this rate to the square footage of the individual Centers. Actual utilities costs experienced at each Center were not incorporated. Thus, we considered estimated utilities costs based upon historical operating cost data at each Center to more reasonably reflect annual savings.

1. b. Code B estimated \$532,505 for utility and maintenance costs associated with the ARC facilities closure. This figure was based upon estimates contained in the June 1994 study and utility rates at DFRC. ARC estimated \$302,086 based upon historical operating cost data which they provided to us. The OIG questioned the difference between the estimates of Code B and ARC [\$532,505 - \$302,086 = \$230,419].

1. c. Code B estimated \$396,032 for utility and maintenance costs associated with the LaRC facilities closure. This figure was based upon estimates contained in the June 1994 study and utility rates at DFRC. LaRC estimated \$209,000 based upon historical operating cost data which they provided to us. The OIG questioned the difference between the estimates of Code B and LaRC [$\$396,032 - \$209,000 = \$187,032$].
1. d. Code B estimated \$388,211 for utility and maintenance costs associated with the LeRC facilities closure. This figure was based upon estimates contained in the June 1994 study and utility rates at DFRC. LeRC estimated \$110,000 based upon historical operating cost data which they provided to us. The OIG questioned the difference between the estimates of Code B and LeRC [$\$388,211 - \$110,000 = \$278,211$].
1. e. Code B estimated \$360,000 for utility and maintenance costs associated with WFF facilities closure. This figure was based upon historical cost data provided by WFF, decremented for security and fire protection. In order to be consistent with the other estimates, we felt WFF's full estimate of utility and maintenance costs should be used as savings due to WFF facilities closure. Thus, OIG questioned the difference between Code B's decremented estimate of WFF facilities costs of \$360,000 and WFF's full estimate of \$401,000 [$\$360,000 - \$401,000 = (\$41,000)$]. The OIG's estimate for WFF utilities and maintenance added \$41,000 to Code B's estimate.
2. The OIG questioned Code B's assessment of \$1.6 million in savings associated with closing the WATR. Funds were allocated to ARC by DFRC for operation of WATR facilities. The total amount for WATR operations included in DFRC's budget has not decreased. DFRC indicated that there are customer requirements for the WATR facility that extend out to FY 1999 and that DFRC will provide the service using ARC WATR Mobile Operations Facilities and personnel transferred from ARC to DFRC. As currently configured, the mobile facilities require support from the parent (server) WATR facility at ARC.

**OIG ANALYSIS OF THE
COST OF LOST RESEARCH**

The concept of lost research cost has been a subject of concern in each of the previous consolidation studies performed. Code B described the cost of lost research as the additional cost that arises due to the geographic separation of the research aircraft from user researchers. Code B stated, "The bottom line for lost research is that it will probably occur, and most likely result in schedule slippage for research programs; the question is how much." The basic premise is that once aircraft are consolidated at DFRC they are no longer readily accessible to users for "hands on" experiments. The cost of lost research was viewed differently by Center researchers, HQ program officials, and the OIG. Because lost research was difficult to measure, we separately identified lost research costs from the other cost elements reviewed in this report.

In the OIG's analysis that follows, the nonrecurring cost of lost research was mainly attributable to LaRC's B-757, Transportation System Research Vehicle (TSRV). The B-757 is presently undergoing an extensive TSRV modification and development effort which will not be completed until FY 1999. However, per an aircraft transition agreement between LaRC and DFRC dated September 13, 1995, the aircraft is to be consolidated at DFRC in September 1997, effectively removing it from scientists' access. The cost associated with this (lost research) was estimated as follows:

<u>Lost Research Costs</u>	<u>Code B Assessment</u>	<u>Note</u>	<u>OIG Cost Adjustment</u>	<u>Note</u>	<u>OIG Adjusted Total (Note 2)</u>
Nonrecurring	\$ -0-	1	\$3,145,329	3	\$3,145,329
Recurring	303,467	1	113,533	4	417,000

Explanatory Notes:

1. In estimating the cost of lost research, Code B solicited input from each Center losing aircraft due to consolidation. Code B solicited additional input from the HQ program offices which reclassified and discounted many of the Centers' estimates. Code B subsequently revised its position on lost research costs by indicating the cost would be minimal due to timely reassignment of researchers to other programs while the 757 is deployed at DFRC. As a result, Code B estimated \$0 for nonrecurring and \$303,467 for recurring costs attributable to lost research. The \$303,467 amount represented cost associated with moving "local" flight tests from LaRC to DFRC (\$110,492) and with basing six major deployments at DFRC (\$192,974). The costs were all associated with the B-757 modifications.
2. Based upon OIG requests for program impact assessments of lost research costs, the OIG received data from ARC, LaRC, LeRC, and WFF (losing Centers). Based upon a review of their costs, we estimated \$417,000 in recurring and \$3,145,329 in nonrecurring costs will more appropriately approximate the cost of lost research. The basis of our estimates is described in Notes 3 and 4 below.
3. Originally, LaRC estimated that moving the B-757 aircraft to DFRC by October 1, 1996, would cost \$12.1 million (includes both added travel costs and lost research costs) above the existing program funding level. On November 9, 1995, based upon the B-757 aircraft transition agreement with DFRC, LaRC revised its estimate stating the cost of this transition would be \$2,684,600 in additional travel

costs and \$6,290,657 in additional lost research costs. These costs would be incurred due to the relocation of the B-757 to DFRC, removing the aircraft from its scientist users. On March 13, 1996, LaRC's Center Director stated that LaRC was in the process of developing a new way of doing business with the B-757 program and that there would not be any cost impacts associated with lost research because the individual researchers and scientists will be reassigned to other programs while the B-757 is at DFRC. LaRC's new plan was scheduled to be presented to Center management in May 1996. According to LaRC's team leader, only preliminary discussions occurred between himself and the team leader for DFRC, and nothing was formalized as to how this new way of doing business on the B-757 program will be accomplished without any lost research (cost) impacts.

Although LaRC now believes that its new way of doing business will not cause any negative programmatic impacts on the B-757 program, it is the OIG's opinion that transfer of the B-757 modification effort to DFRC will not occur without significant impacts. As such, we estimated nonrecurring lost research costs based upon LaRC's revised B-757 aircraft program estimate dated November 9, 1995. The OIG considers LaRC's estimate to be reasonable because LaRC has over 20 years of experience operating and maintaining the B-757 and B-737 aircraft programs; and when developing this cost impact, LaRC met with DFRC personnel to establish how the B-757 would transition to DFRC. The OIG classified these lost research costs as nonrecurring because they were identified specifically to the B-757 TSRV modification effort.

Based upon a review of LaRC's revised assessment, we estimated the impact and cost of lost research on the B-757 aircraft modification effort in the following three categories: (1) direct workforce impact (2) indirect workforce impact due to inefficiencies, and (3) lost access to aircraft. Each of these categories is explained in detail below.

A. Direct Workforce Impact:[30.4 work years × \$79,036 (LaRC average annual cost per employee)]	\$2,402,694
B. Indirect Workforce Inefficiencies: [47.5 work years × \$79,036]	3,754,210
C. Lost Access to Aircraft: [88 weeks × \$79,036 ÷ 52 weeks per year]	<u>133,753</u>
TOTAL LaRC Lost Research Costs	\$6,290,657
OIG Decrement Factor	×50%
OIG Estimated Nonrecurring Lost Research Costs	<u>\$3,145,329</u>

A. Direct Workforce Impact: The \$2,402,694 cost is based on LaRC's estimate of additional workforce years necessary to conduct the post B-757 Block 2 and 3A modification familiarization, envelope expansion, and major research flights at or from DFRC under the present modification plan. The driver in this case was that these flights will be conducted at DFRC, or out of DFRC rather than out of LaRC, effectively removing a significant portion of the research, engineering, and technical team from the development effort for significant periods of time. These impacts were termed "direct" because they removed quantifiable workforce hours from the development effort, which resulted in stretching the schedule or adding more workforce to the program.

- B. Indirect Workforce Inefficiencies: The \$3,754,210 cost is based on LaRC's estimate of the indirect impact of the B-757 aircraft transition plan on the balance of the LaRC development effort, i.e., the productivity of the approximately 85 researchers, engineers, and technicians who will not be deployed to DFRC to support transition or deployment efforts. During significant periods of the development, up to 28 members of the design and development team will be deployed to DFRC to support transition, check-out, and research activities. LaRC estimated a 25 percent impact on the effectiveness of the development team.
- C. Lost Access to Aircraft: The \$133,753 cost is based on LaRC's estimate of lost time that will occur when the B-757 development team will not have access to the aircraft to perform design checks, system tests, installation and system verification, once the aircraft is moved to DFRC. This loss of access will prolong the development process 88 weeks producing the additional costs.

In the interest of being conservative, the OIG judgmentally applied a decrement factor of 50 percent to LaRC's estimate of cost impact. Therefore, the OIG estimated the cost of lost research to be \$3,145,329 (\$6,290,657 × 50%) while modifications 2 and 3A are being completed on the B-757 aircraft program.

- 4. The OIG's estimate of recurring costs for lost research was based upon estimates provided by the following Centers:

<u>Cost of Lost Research*</u>	
ARC/Rotorcraft	\$480,000
ARC/Earth Science	82,000
LeRC/Microgravity	<u>272,000</u>
Subtotal	\$834,000
OIG Decrement Factor	<u>× 50%</u>
OIG Estimated Recurring Lost Research Costs	<u>\$417,000</u>

* Amounts shown were annual recurring costs and represented the additional costs of lost productivity due to the geographic separation of the research aircraft from their scientist users.

Being conservative, the OIG estimated that 50 percent of the Centers' projections can reasonably be expected as the recurring cost of lost research. The OIG's total estimated cost of recurring lost research was \$417,000 (\$834,000 × 50%).

It should be noted that not all Center science programs evaluated the cost of lost research that may occur due to the aircraft consolidation at DFRC.

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SCHEDULE OF AIRCRAFT TO BE CONSOLIDATED, DECOMMISSIONED, AND DISPOSED

AIRCRAFT TO BE CONSOLIDATED

<u>Center</u>	<u>Aircraft</u>	<u>NASA #</u>	<u>Program & Code</u>	<u>Owner</u>
ARC	Lear 24	705	Infrared Measurements (Code R)	NASA
	ER-2	706	High altitude remote sensing (Code Y)	NASA
	ER-2	709	High altitude remote sensing (Code Y)	NASA
	DC-8	717	Airborne earth science (Code Y)	NASA
	YO-3A	718	Acoustics research (Code R)	NASA
	NAH-1S	736	Display (Code R)	US Army
	UH-60	748	Airloads (Code R)	US Army
	UH-60	750	RASCAL (Code R)	US Army
	T-38A	910	Pilot Proficiency (Code R); to JSC	NASA
LaRC	T-34C	509	Chase aircraft for 737/757 (Code R)	US Navy
	T-38A	511	Pilot Proficiency (Code R); to JSC	NASA
	OV-10A	524	Advanced Subsonics (Code R)	NASA
	UH-1H	535	Drop Model Tests (Code R)	NASA
	B757	557	TSRV (Code R)	NASA
LeRC	DHC-6	607	Icing Research (Code R)	NASA
	Lear 25	616	Support Aircraft (Code R)	NASA
	T-34C	618	Remote Sensing (Code R)	US Navy
	DC-9	650	Microgravity (Code U)	DOE
WFF	T-39E	425	Laser altimeter, (Code Y)	NASA
	P3B	426	Greenland ice cap mapping (Code Y)	NASA
	C-130Q	427	Global positioning system (Code Y)	NASA

**SCHEDULE OF AIRCRAFT TO BE CONSOLIDATED,
DECOMMISSIONED, AND DISPOSED**

AIRCRAFT TO BE DECOMMISSIONED

<u>Center</u>	<u>Aircraft</u>	<u>NASA #</u>	<u>Disposition</u>	<u>Owner</u>
ARC	BE200	701	Decommission	NASA
	XV-15	703	Decommission	NASA
	C-130B	707	Decommission	NASA
	UH-1	734	Decommission	NASA
LaRC	BE-80	506	Decommission	NASA
	B-737	515	Decommission	NASA
	U21A	518	Decommission	NASA
	Lear 28	566	Decommission	NASA
LeRC	T-34B	614	Decommission	NASA
	OV-10D	615	Decommission	NASA
	OV-10A	636	Decommission	NASA
WFF	UH-1H	415	Decommission	NASA
	F-27	432	Decommission	NASA

DISPOSITION OF OTHER AIRCRAFT

<u>Center</u>	<u>Aircraft</u>	<u>NASA#</u>	<u>Disposition</u>	<u>Owner</u>
ARC	YAV-8B	704	Store	US Navy
	ER-2	708	Transfer to USAF	USAF
	C-141	714	Store at DFRC	NASA
	AV-8C	719	Display	US Navy
	UH-60	749	To US Army	US Army
LeRC	T-34C	619	To US Navy	US Navy
SSC	Lear 23	933	Commercialize	NASA

**DISPOSITION OF PERSONNEL STAFFING LEVELS
THROUGH CONSOLIDATION***

	<u>Before Consolidation</u>		<u>Personnel Losses</u>		<u>Personnel Remaining</u>	<u>Personnel Synergy Savings</u>	<u>Final Personnel Staffing</u>
	<u>Direct Only</u>	<u>With Indirects</u>	<u>by Program Decommissioning</u>	<u>by Consolidation</u>			
Civil Servants	202.3	252.9	89.1	4.6	159.2	9.2	150.0
Support Staff (Contract)	<u>250.3</u>	<u>250.3</u>	<u>101.0</u>	<u>4.5</u>	<u>144.8</u>	<u>4.8</u>	<u>140.0</u>
Total	<u>452.6</u>	<u>503.2</u>	<u>190.1</u>	<u>9.1</u>	<u>304.0</u>	<u>14.0</u>	<u>290.0</u>
		(a)	(b)	(c)	a - b - c	(d)	a - b - c - d

* Figures presented represent full-time equivalent positions.

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CONSOLIDATION OF AIRCRAFT CHRONOLOGY

BACKGROUND: In total, NASA has approximately 100 active aircraft classified as mission management, program support, and research and development (R&D). The present consolidation plan calls for transferring 21 of these aircraft to DFRC in support of NASA's aeronautical research programs. A brief chronology follows:

<u>Date</u>	<u>Report/Analysis</u>	<u>No. of Aircraft</u>	<u>Initial Costs</u>	<u>Annual Savings/(Costs)</u>
11/93	Aeronautics Mgt Council Report	18	\$70.0M	\$9.0M
2/95	Red Team's White Paper	- DFRC should prepare to receive program aircraft -		
4/95	Dryden Study	23	\$22.4M	\$12.6M
5/95	Zero Base Review	- Directive to Consolidate -		
10/95	OIG Discussion Rapid Action Report	21	\$33.9M	\$2.5M
10/95	Code R Briefing to Assistant to the President for Science and Technology	21	\$22.9M	\$9.0M
11/95	OIG Draft Rapid Action Report	21	\$32.2M	(\$1.5M)
12/95	NASA Response to OIG Report	- Agree to independent assessment -		
12/95	OIG Final Rapid Action Report	21	\$32.2M	(\$1.5M)
12/95	Code B's Draft Assessment	20	\$49.1M	\$2.0M
2/96	Code B's Final Assessment	19	\$ 9.3M	\$7.2M
3/96	OIG Letter	19	\$22.4M	\$1.6M
3/96	Code B's Revised Assessment	21	\$10.0M	\$4.5M
6/96	OIG Draft Report	21	\$12.4M	\$0.2M
6/96	Code B's Revised Assessment	21	\$ 8.0M	\$4.5M

November 1993: The Aeronautics Management Council under the Office of Aeronautics issued its report which concluded that the consolidation of all NASA aircraft to Dryden would initially cost \$70 million and total annual recurring cost savings were estimated at \$9 million. With this, the payback period after consolidation was estimated at 8 years. Based on these figures, it was concluded that it was not cost effective to consolidate.

Within the report were four alternatives to the above recommendation, as follows:

- East-West Coast Operations (WFF & DFRC)

- One Center Operation - ARC/Moffett & DFRC (Please note that at the time of this report, Dryden was still a part of Ames.)
- Three site Operations (ARC, DFRC, WFF)
- Specific Realignments of Current Operations. This alternative was cited as the most favorable implementation for minimum adverse program impact. Flight research operations would remain as an integral function at each Center, improving the connectivity between the center researchers and customers, while enhancing the product value of their work. The high initial costs of consolidation would be avoided. The senior management attention initiated as a result of this assessment could serve as an opportunity to direct specific realignment actions at each Center. The intention was to reduce operating costs by utilizing existing assets more effectively and ensuring greater reliance on the assets and capabilities that exist at other Centers.

February 2, 1995: The NASA Red Team's White Paper was issued. The paper provided a starting point for discussions on a proposed realignment of center roles and missions. The review process which was to follow this paper would identify options to help the Agency streamline its vital functions within its available resources. The reviews would identify opportunities to reinvent NASA using stated principles and a budget reduction strategy.

The specific ideas regarding aircraft consolidation were:

- Airplane-based science and applications as well as sounding rocket programs should be evaluated for cost effectiveness.
- Dryden should prepare to receive program aircraft from other NASA Centers.

April 4, 1995: The Dryden Study is summarized as follows:

- All aircraft, people, labs, shops, and equipment could be accommodated within existing DFRC & Air Force facilities.
- Cost was \$22.4 million with annual savings of \$12.6 million
- Payback period was 3 years.
- Impacts to programs could be minimized by developing a detailed transition plan for each aircraft.
- Modern information technology should be used to mitigate DFRC's remote location (e.g. virtual control room, video conferencing, and computer networking).

Some early concerns with the findings were:

- There should be a cost benefit analysis regarding separation of researchers from their aircraft.
- The program offices needed to look at costs and impacts to their programs and customers.
- There was concern that DFRC would not be able to minimize the impact to programs.

May 10, 1995: Final briefing by the Zero Base Review team recommended the consolidation at DFRC of all aircraft other than those in support of the Space Shuttle. The primary difference from the Aeronautics Management Council study was that the U.S. Air Force hangers would be available for NASA's use.

October 5, 1995: OIG issued for validation a draft Rapid Action Report (RAR) to the affected centers and HQ program codes. The RAR found that the recurring savings would be \$2.5 million with up-front costs of \$33.9 million. We recommended NASA discontinue its plan to consolidate aircraft at DFRC until the full cost and programmatic impacts were determined.

October 30, 1995: Briefing to Assistant to the President for Science and Technology, by Associate Administrator, Code R. Details follow:

- Nonrecurring Costs = \$22.9 million
 - Lab setup = \$7.0 million
 - Aircraft/equipment moves = 7.0 million
 - People moves = \$8.9 million
- Annual Savings = \$9.0 million
- Consolidation would result in:
 - fewer aircraft and personnel required to accomplish the program activities
 - lower annual operating costs
 - standardized operations and safety procedures
 - better management of scarce resources

November 22, 1995: OIG issued the draft Rapid Action Report to Code AT/Associate Deputy Administrator (Technical) with no changes to the October 5, 1995, recommendation. Recurring costs were estimated to be \$1.5 million with up-front costs of \$32.2 million.

December 6, 1995: NASA responded to draft Rapid Action Report and expressed serious reservations that the OIG analysis did not consider Agencywide implications of downsizing initiatives. The CFO/Comptroller was tasked to conduct a thorough analysis of the consolidation recommendation, including full cost, programmatic, and operational impacts.

December 7, 1995: OIG issued final Rapid Action Report (HA-96-001) with no changes to the findings and recommendation.

December 13, 1995: NASA Comptroller issued a draft (1st) assessment which estimated the nonrecurring costs of \$49.0 million and annual savings of \$2.0 million for 20 aircraft.

February 8, 1996: NASA Comptroller issued final (second) assessment which had up-front costs of \$9.3 million and annual savings of \$7.2 million. The payback period was 2.0 years.

March 8, 1996: OIG letter to the Acting Deputy Administration concluded from a review of the NASA Comptroller's February 8, 1996 assessment, that consolidation of 19 aircraft would result in nonrecurring costs of \$22.4 million and annual savings of \$1.6 million, for a payback period of 14.3 years. When adjusted for the cost of money (currently 6 percent), this project would take approximately 33 years to recover the initial investment.

March 15, 1996: The NASA Comptroller prepared a third assessment and estimated up-front costs of \$10.0 million with annual savings projected to be \$4.5 million for 21 aircraft.

June 4, 1996: OIG draft report was issued. The OIG found that many of Code B's assumptions and cost savings projections were optimistic and associated cost estimates did not adequately reflect actual cost history. The OIG's draft analysis of Code B's March 15, 1996 assessment estimated nonrecurring costs of \$12.4 million and annual savings of about \$173,000 resulting in a payback period of 72 years. This assessment was based on the assumption that NASA would consolidate 21 aircraft at DFRC, decommission 13 aircraft, and dispose of or store 7 other aircraft.

The OIG agreed with Code B that the decommissioning of aircraft would produce real cost savings to NASA. In this regard, Code B estimated \$21.8 million in savings could be achieved by decommissioning aircraft no longer

*Substantive
on next page*

The OIG agreed with Code B that the decommissioning of aircraft would produce real cost savings to NASA. In this regard, Code B estimated \$21.8 million in savings could be achieved by decommissioning aircraft no longer having a programmatic need. The OIG recommended that NASA should immediately begin decommissioning these aircraft to achieve maximum cost savings.

June 28, 1996: NASA management responded to the OIG draft report recommendation to reevaluate its decision to consolidate by reevaluating its assessment (fourth) which showed:

- nonrecurring costs of \$8.0 million
- annual recurring savings of \$4.5 million
- a payback period of 3 years

July-August 1996: OIG received additional information such as:

- A draft Langley Report (6/10/96) reassessing the costs associated with transferring the LaRC B-757 aircraft to DFRC. The draft report detailed NASA's descoping effort which appeared to have shifted additional programmatic costs to future periods. To date, this report has not been finalized and no decision has been reached.
- A revised LeRC estimate (7/19/96) of cost and technical impacts on LeRC's DC-9 Microgravity Operations by aircraft consolidation was one percent above its original estimate.
- A letter from the Director, Microgravity Science and Applications Division stating that moving the DC-9 aircraft to DFRC would cost more than it saves. In addition, the Director agreed to a review of the DC-9 along with a KC-135 at Johnson Space Center to determine which platform best meets the microgravity community's requirements.

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National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001



JUN 28 1996

TO: W/Inspector General
FROM: AD/Acting Deputy Administrator
SUBJECT: NASA Aircraft Consolidation

We appreciate your support during the Agency review of the Inspector General Draft Report on Audit of Aircraft Consolidation at the Dryden Flight Research Center. The assessments of your staff have assisted us in focusing on the few specific issues that remain to be resolved. In response to my request to you and the Chief Financial Officer (CFO) to address these issues, Arnold Holz has provided the enclosed assessment. Our discussions on the draft report are now complete. The CFO assessment represents the official Agency response, and as such, we request its incorporation in your report and your prompt attention to final issuance.


J. R. Dailey

Enclosure

cc:
AT/M. Mott
B/M. Peterson
J/B. Cooper
L/J. Lawrence
R/R. Whitehead
U/A. Nicogossian
Y/W. Townsend

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001



JUN 28 1996

Reply to Attn of:

B

TO: AD/Acting Deputy Administrator
FROM: B/Chief Financial Officer
SUBJECT: Aircraft Consolidation Independent Cost Assessment

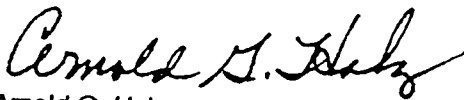
You asked the Office of the Chief Financial Officer to conduct an independent review of the expected costs and savings associated with the consolidation of research aircraft at Dryden Flight Research Center. Our initial report was on February 8. The Inspector General took exception to the management assumptions and cost estimates and issued a draft report which continued to challenge the Comptroller's assessment. At your direction, I specifically requested that a reevaluation of the consolidation plan and cost estimates be performed and discussions held with the OIG to try to eliminate, or significantly reduce differences. The reevaluation was to include an assessment of the reasonableness of the underlying assumptions, as well as sensitivity testing of the estimates. The report on the cost assessment (copy enclosed) shows that:

- Nonrecurring costs total \$8 million;
- The estimated net annual recurring savings from consolidation total \$4.5 million;
- The payback period is approximately 3 years.

The report also concludes that estimated annual savings from decommissioning of aircraft exceeds \$21 million. These savings are particularly noteworthy because, while they are not completely attributable to the consolidation effort, the effort did stimulate a further review of aircraft utilization.

Based upon my review of the work performed, I believe that the cost assessment is objective, accurate and applies a reasonable level of conservatism to the estimates. As such, I find that it more than adequately supports the decision of management to proceed with aircraft consolidation. It is my recommendation that the cost assessment be made an integral part of our response to the Office of the Inspector General's draft report.

I would be pleased to discuss this issue with you at your convenience.


Arnold G. Holz

Enclosure



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OFFICE OF THE CHIEF FINANCIAL OFFICER

Aircraft Consolidation at the Dryden Flight Research Center

Independent Cost Assessment

June 27, 1996

Prepared by:

**Malcolm L. Peterson, Comptroller
Claude W. Frenner, Systems & Cost Analysis Division**

**National Aeronautics and Space Administration
Aircraft Consolidation Plan
Independent Cost Analysis**

This is an independent estimate of the expected costs and projected savings associated with the consolidation of NASA aircraft at Dryden Flight Research Center (DFRC). This assessment is based on the management representations, best engineering judgments, and cost analyses provided by responsible management officials at NASA Headquarters, based on program plans, schedules and cost data generated by personnel at the NASA field installations.

The estimate has been categorized in four parts: the non-recurring, or one-time, costs associated with consolidation; the recurring annual cost savings (cost avoidance) resulting from consolidation; the recurring annual added costs caused by consolidation; and the annual recurring savings resulting from decommissioning of aircraft for programmatic reasons. This last category, programmatic decommissioning, while not strictly a result of the consolidation of aircraft at DFRC and thereby listed separately, has been shown because the consolidation effort caused NASA Program Officials to re-examine the marginal value of all aircraft, and has enabled the projected savings.

Summary Of Independent Cost Analysis

Estimated Nonrecurring Cost (\$FY1996):

Aircraft Ferry, Fuel & Parts	\$0.1M
Ground Support Equipment Transfer	\$0.1M
Laboratory Setup	\$0.9M
Paperwork & Records	\$0.2M
Personnel Relocation	\$5.1M
Personnel New Hires	\$0.3M
Personnel Training	<u>\$1.0M</u>
Total Nonrecurring	\$8.0M*

Estimated Recurring Savings/Costs:

Annual Savings:

Personnel, Decommissioned Aircraft	\$0.8M
Aircraft Ferry, Fuel & Parts	\$1.1M
Personnel, Consolidation Synergism	\$1.3M
Facility Closing	<u>\$3.9M</u>
Total Recurring Savings	\$7.1M

Annual Added Costs:

Aircraft Ferry, Fuel & Parts, Commercial Air Travel	\$1.2M
Personnel Per Diem	\$0.6M
Personnel Car Rental	\$0.1M
Hangar Rental	<u>\$0.7M</u>
Total Added Costs	\$2.6M

Net Annual Recurring Savings: **\$4.5M**

Payback Period **3 years**

**Annual Recurring Savings From
Program Decommissioning of Aircraft:** **\$21.8M**

* Numbers do not add exactly due to rounding.

Management Assumptions:

All research and support aircraft at Ames Research Center (ARC), Langley Research Center (LaRC), Lewis Research Center (LeRC), and Wallops Flight Facility (WFF) are being consolidated at DFRC, and the ARC and LaRC T-38 aircraft are being transferred to Lyndon B. Johnson Space Center (JSC) to replace two older aircraft. Administrative aircraft were not considered in the analysis. There are 19 operational aircraft being transferred to DFRC, one aircraft transferred to DFRC for parts, one aircraft transferred to DFRC for storage (non-flying status), three aircraft transferred to DOD, one aircraft bailed to a contractor, one aircraft stored at ARC, one aircraft displayed at ARC, two aircraft transferred to JSC, and 14 aircraft decommissioned. Two of the 14 decommissioned aircraft are T-38s at JSC, enabled by transfer of newer aircraft from ARC and LaRC as a direct result of consolidation. Two more of the 14 decommissioned aircraft, a T-34B and an OV-10A, are also a direct result of consolidation.

Aircraft being decommissioned, but not as a direct result of consolidation, were determined by NASA management to have low marginal value. All personnel billets associated with these programmatic decommissioned aircraft are assumed to be deleted without replacement. Future cost avoidance (annual savings) associated with these aircraft will be based on the decrease in personnel and the avoidance of annual operations and maintenance costs.

Elements of the Western Aeronautical Test Range and aircraft support facilities at Centers will be closed as a result of the consolidation of aircraft at DFRC. This will result in savings due to avoidance of costs for utilities and routine maintenance, and further savings (cost avoidance) due to not incurring the major periodic maintenance and overhaul costs involved in keeping facilities in operational status. The combination of the regular operations and maintenance and major periodic maintenance costs together represent the "cost of ownership" of the facilities.

Estimating Ground Rules and Assumptions:

General

Aircraft pre- and post-consolidation status, by tail number, were compiled by DFRC, and were based on Center and Headquarters inputs.

A conservative approach was used for the payback analysis, in that the costs of consolidation were recognized in the year of occurrence and recognition of savings was deferred until the following year. In discounting the cost and savings flows by year, this approach tends to defer the point at which the internal rate of return is achieved. Cost of money (discount rate) is assumed to be the cost of a 10 year Treasury note (5.99%) from the 11/12/95 Washington Post. Annual inflation is assumed to be 4.0%.

Pre-consolidation personnel counts associated with each aircraft were provided by the appropriate Centers. Post-consolidation estimates of personnel requirements were provided by DFRC.

The Civil Service (CS) estimated costs are based on average burdened compensation (source: FY1996 NASA budget) and include Salary, Benefits, Relocations, Investigative Services, Training, Facilities Services, Technical Services, and Management and Operations. To simplify the analysis, Service Support Contractor (SSC) estimated costs were assumed to be the same cost per capita as CS; this is also a conservative assumption because experience indicates the SSC costs tend to be lower than CS costs..

Non-recurring:

Aircraft Ferry, Fuel and Parts: approximate cost of ferry to DFRC provided by Center flight operations personnel. Where the Center personnel lacked experience with the costs of ferrying a given aircraft, it was assumed the costs are the same as similar-sized aircraft.

Ground Support Equipment (GSE) Transfer: Centers originally provided estimates of moving all GSE. The estimate used in this report was provided by DFRC, based on actual site visits by DFRC personnel to determine what GSE was actually needed.

Laboratory Setup: Estimates for the laboratory equipment required at DFRC for the ARC aircraft (DC-8 and ER-2) were provided by Office of Mission To Planet Earth (Code Y). Estimates for LaRC B-757 were provided by DFRC following discussions with LaRC and Office of Aeronautics (Code R).

Paperwork and Records: Preparation of aircraft and records associated with the transfer of the aircraft was considered immaterial, except for the case of the LaRC B-757 move, where LaRC personnel desired retention at LaRC of a duplicate set of aircraft documentation for the B-757. In the other instances, the costs were considered immaterial because the cost would only consist of a small amount of time by Civil Service or Service Support Contractor personnel. Salaries would be paid regardless, so no cost impact was included.

Personnel Relocation: The number of CS personnel expected to relocate (70) was provided by DFRC based on unofficial surveys of affected personnel (a survey indicated 50 to 60 personnel were agreeable to the relocation). DFRC FY1995 actual move costs for 18 personnel served as the basis for calculating the move costs of Civil Service. Current NASA policy stated by Headquarters officials is that SSC move costs are not paid by the government except in special circumstances. An exception to this was made based on approval of contract modifications by Code Y management; in this instance, \$2M was allocated to move selected SSC personnel to DFRC to assure the retention of needed skills in the contractor work force.

Personnel New Hires: The balance of the additional Civil Service personnel needed at DFRC after accommodating personnel transfers would be accomplished through new hires. The new hires were assumed to be hired from the local area (80%), or outside local area (20%); this ratio was used based on DFRC management assessment of local job market. Local hires will have no household goods shipment costs or other employment expenses. Outside local area hires are estimated at the same cost as DFRC Civil Service Transfers without guaranteed home sales, but with family travel, temporary accommodations and household goods shipments.

Personnel Training: All SSC and CS personnel (except flight crews) are assumed to be hired based on the assumption that they are fully trained for the specific job. This assumption was based on the assessment by DFRC management as to the available labor pool of trained personnel in the immediate area. Their assumption appeared reasonable based on the downsizing of aerospace industries in the local area, and the resulting availability of personnel. Flight crew training estimates were based on costs provided by LaRC officials.

Added (non-recurring) Travel: LaRC provided a specific draft consolidation plan as of June 10, 1996, with detailed analysis and estimate of travel expenses needed for the transfer of the B-757 to DFRC. Non-recurring costs for flight crews ferrying aircraft have been included in the category Aircraft Ferry, Fuel and Parts, above.

Recurring Annual Savings:

Personnel, Decommissioned Aircraft: These are billets associated with aircraft specifically being decommissioned as a result of the consolidation. The CS and SSC estimated costs are based on average burdened compensation as explained above in the general ground rules and assumptions.

Aircraft Ferry, Fuel, and Parts: These estimated costs are for aircraft specifically decommissioned due to consolidation, and are based on data provided by the LaRC, except for the T-38 aircraft which is based on data provided by JSC. This data was determined by Code R management to include both variable operating costs and fixed cost of ownership. The average variable cost per hour for operating a T-38 was applied to the 1995 operations hours for the ARC and LaRC T-38 aircraft. The average fixed cost of ownership for a T-38 was then added to this to calculate the total savings (cost avoidance) for the two aircraft. The two older aircraft at JSC that are being replaced need extensive overhaul and modification, costs for which no estimate was available. These avoided costs were not included in the savings estimates; this omission contributes to the final calculation being conservative.

Personnel, Consolidation Synergism: The basic concept of synergism is that, because of a larger number of aircraft in one location, personnel assigned will have less opportunity for unproductive idle time. Data was provided by DFRC based on detailed assessments of labor requirements. This data was then discounted in this cost estimate to more conservative values (less synergism allowed) because of estimator judgment

regarding the potential for a fleet of dissimilar aircraft to allow for less synergism than would be the case with a fleet of aircraft having fewer part types.

Facility Closing: Estimates were based on the assessment of facility costs at Centers provided by Code R using a specific study of facility ownership costs conducted in 1994 for the National Facilities Study. This "cost of ownership" estimate is believed to provide a better, more comprehensive estimate of the costs incurred over time to retain facilities in operable conditions. The savings for post-consolidation cessation of operation of Western Aeronautical Test Range (WATR) elements at ARC and transfer of portions of its equipment to DFRC was included based on comparing the budgetary estimates for unconsolidated and consolidated operations. This data was provided by DFRC, the installation with budgetary responsibility for the WATR.

Recurring Annual Added Costs:

Recurring Annual Added Costs consists of only two elements. The added cost of the C-17 Hangar rental at DFRC from the USAF is estimated based on negotiated cost data supplied by DFRC. The remaining element is the cost of added travel expected to occur because scientists and engineers are no longer co-located with the aircraft. Commercial air fares and car rental costs were obtained from the NASA Headquarters Travel Office. Per diem rates were taken from published GSA travel rates (available on the internet at <http://www.fss.gsa.gov/perdiem.html>). Additionally, \$10 per day was added to the per diem rates as an allowance for incidentals, and \$10 per day was added to the car rental rates for gasoline, parking, etc. Detailed estimates of the number of trips involved were supplied by Centers, Code R, and Code Y. The trip estimates for LaRC, WFF, JPL, DFRC and ARC have been iteratively scrubbed as consolidation plans have become more detailed.

LeRC's estimate of the added annual travel costs have not been modified since the initial Center input. This input was provided prior to the introduction of the concept that an "institute" could be the operator of the DC-9 microgravity flight experiment aircraft. A revised estimate is not available to reflect this still conceptual, unapproved approach. Accordingly, in the absence of a better estimate from LeRC, the original estimate was retained. The LeRC estimate appears likely to overstate the probable level of future costs since the estimate would amount to approximately 50% of the entire LeRC annual travel budget for all programs. This is probably overly conservative.

Sensitivity Analysis

The current estimate, or baseline, for sensitivity analysis shows payback occurring during 1999. A sensitivity analysis was performed to determine the effect estimating errors might have on the calculated point. For this purpose, costs were assumed to be higher or lower by 20%; the discount rate, or cost of money, sensitivity was analyzed at 10%; and the inflation rate was also analyzed at 10%. Results are as shown:

<u>Case</u>	<u>Factor</u>	<u>Payback</u>
Baseline	Current Estimate	FY1999
Increase Non-recurring	N/R + 20%	FY1999
Decrease Non-recurring	N/R - 20%	FY1999
Increase Recurring Savings	R + 20%	FY1999
Decrease Recurring Savings	R - 20%	FY2000
Worst Case	N/R + 20%, R - 20%	FY2000
Discount Rate 5.99% to:	10%	FY1999
Inflation Rate 4.0% to:	10%	FY1999

The LeRC annual added cost of travel has not been modified from the original Center input, although the Center is currently working this issue. The amount of this annual cost (\$1.86M) is approximately 50% of the total LeRC annual travel budget (\$3.5M). If this annual added cost can be reduced by 50% through different methods of operation, the payback for the Agency will occur in 1998. This would still be 26% of the annual travel budget for LeRC, and is still considered conservative.

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OIG EVALUATION OF NASA MANAGEMENT'S RESPONSE

We have evaluated management's response and subsequent information provided since our June 4, 1996 draft report of the aircraft consolidation plan for reasonableness within the context of previous assessments. OIG comments on programmatic impacts, specific elements of management's assumptions and the associated cost impacts are summarized in the following sections:

CONSOLIDATION EFFECTS ON PROGRAM SCIENCE RESEARCH

Airborne science aircraft include large multi-engine testbeds, such as the DC-8 (ARC), the B-757 (LaRC), the DC-9 (LeRC) and the C-130 (WFF). As described by a NASA aircraft operations branch: "Each aircraft is uniquely configured to fly research missions in support of various science or aeronautics programs, and are deeply integrated within their Center's technical support infrastructure. In general, the costs associated with the operation of these aircraft are principally driven by research support requirements, i.e., modifications, research hardware, flight hours, and travel as required to support the technical program. Because testbed aircraft are such an integral part of each Center's programs and technical support infrastructure, where an aircraft is based has a significant effect on operating costs and quality service to programs."

DFRC's current complement of aircraft are primarily used for flight research, which involves using the planes as the actual test articles for aerodynamic configurations and direct flight control hardware. However, the majority of the aircraft transferring to DFRC are not flight research aircraft but airborne science aircraft.

DFRC is primarily a flight research center, not an airborne science research center. The airborne science research centers have built up synergism and capabilities over the years between the researchers, experiment integrators, mission planners, engineers and operations personnel (including specially trained flight crews). Dismantling established research facilities and moving the research aircraft will cause inefficiencies during planning, integration and deployment.

Examples include:

B-757 AT LARC

Originally, DFRC and LaRC agreed that approximately a comparable level of program effort was to be accomplished after the consolidation occurred. Under the current proposed B-757 plan, NASA has descoped the plans for the aircraft. The descoping of the B-757 does not accomplish the purpose for which the aircraft was purchased -- a replacement for the B-737, with additional research capabilities. Specifically, the research flight deck (a research cockpit cabin installed behind the forward cabin) was removed from the aircraft's design. Elimination of this module reduced program costs from \$18 million to \$12 million and enabled the aircraft to be delivered in a baseline configuration. The descoping plans also eliminated local and major deployments until the transfer to DFRC.

Additional program impacts which may affect Code B's costs assessments include:

1. Additional upgrading of DFRC's existing remote access/telemetry data in real time will most likely be required to support the descoped program as currently proposed. LaRC has estimated only \$300,000 non-recurring costs and \$100,000 recurring costs for this remote access/telemetry capability. Per LaRC managers, the actual cost for this remote access/telemetry capability may be higher.
2. DFRC will now be responsible for designing, fabricating, and installing the upgrades to the research system needed to bring the B-757 up to its intended goal of being a full replacement for the B-737. If DFRC does not have the in-house staff capable of performing this level of effort on the B-757, then this added capability may cost DFRC additional personnel, travel, etc.
3. DFRC may have to duplicate some of LaRC's staffing in order to operationally support the B-757 program as now proposed under the current descoping plan. This additional DFRC staff would be above and beyond the current 290 personnel level already identified with the DFRC aircraft consolidation.
4. There may be a requirement for a new Full Motion Simulator Cab and new Testing Facility for Simulation-To-Flight compatibility with the descoped aircraft. The possible need for these new facilities was created by the descoping plans.

5. According to LaRC managers, because of the unique configuration of the B-737/B-757 program, it is inappropriate to estimate that no familiarization flights will occur between LaRC and DFRC crews. Both from a technical and safety point of view, some number of familiarization flights between LaRC and DFRC can reasonably be expected to occur. No costs associated with these type of familiarization flights has been included within LaRC's latest estimate.

DC-9 AT LERC

The microgravity program consists of ground-based research and spaceflight experimentation to include future use of the International Space Station. This research is conducted using aircraft like the DC-9, drop towers, and Shuttle experiments. LeRC is a focus of microgravity research because of its complement of drop towers, the DC-9, researchers, lab facilities and technicians. Microgravity personnel stated that transfer of the DC-9 to DFRC would increase the cost of research using the aircraft and increase the need for intensive mission planning because of the loss of synergism between facilities, the researchers and technicians that currently exists at LeRC. Because of these inefficiencies and increased costs, the DC-9 would be used as a testing platform "of last resort" by microgravity program researchers, rather than the powerful research and flight hardware risk-reduction tool that it has become while based locally at LeRC. A decrease in microgravity science support may occur and opportunities to exploit the full potential of the International Space Station for microgravity research will be diminished.

Also, relocating the DC-9 to DFRC would increase travel and shipping costs. The demographics of researchers and experiments are critical in estimating recurring program costs because they determine travel and shipping requirements. Approximately 73 percent of the DC-9 researchers are located within 500 miles of LeRC. See Appendix IV for DC-9 researchers demographics.

UH-1H AT LARC

At present, aircraft models are tested in wind tunnels and then results are often verified during drop testing from the UH-1H helicopter. The transfer of a UH-1H helicopter from LaRC to DFRC will have an adverse impact on the drop testing phase of research programs. Separation of the research personnel who perform drop testing from the personnel who perform related wind tunnel and spin tests will adversely affect the research program as a whole.

The research program includes drop testing models over water. If these models are instead dropped over the dry lake bed at DFRC, the test models may be damaged. According to a LeRC manager, the drop testing program would likely end if the helicopter is transferred to DFRC due to the absence of a body of water over which to perform these tests.

DHC-6 AT LeRC

The DHC-6 at LeRC is presently being used in support of Supercooled Large Droplet (SLD) Icing Flight Program research. This research is being jointly conducted by NASA, the Federal Aviation Administration (FAA) and the National Center for Atmospheric Research (NCAR). The reason this type of research is being conducted at LeRC, is because: (1) The FAA/NCAR has dictated that SLD flights be conducted over the Great Lakes area, which is in direct response to the October 31, 1994, American Eagle Flight 4184 ATR-72 crash near Roselawn, Indiana; (2) Air traffic in the Great Lakes region is heavy and includes a high volume of commuter traffic that is at risk from SLD icing; and (3) SLD icing is more common east of the Mississippi. The SLD research is presently scheduled to be completed within the next two years. By moving the DHC-6 before the research is completed, it will adversely impact the SLD research.

LEARJET AT LeRC

The Project Engineer of the Solar Cell research program stated that transfer of the Learjet to DFRC would necessitate extra travel costs to sustain this research. DFRC indicated to LeRC that the program would have to fund these additional costs. These travel costs are three times the Solar Cell program's current travel budget. The Project Engineer felt that this would be an insurmountable cost for the program and that "consolidation will, in all likelihood, kill the program, an irreplaceable loss to both NASA and U. S. industry."

PROGRAM IMPACTS AT ARC

According to program management at ARC, the Rotorcraft program will suffer at DFRC as the increased density altitudes at DFRC will negatively impact the performance capabilities of the helicopter and Vertical/Short Takeoff and Landing research aircraft. Other impacts will result from the geographical separation of the research pilots from ARC's simulators; e.g. Vertical Motion Simulator. The loss of the specialized expertise of the ARC WATR personnel will significantly impact data analysis and range support at DFRC until this expertise is developed at DFRC.

ARC program impacts identified by ARC's researchers as well as non-NASA visiting researchers and scientists include the loss of being

collocated in the "Silicon Valley" with its high technology resources. Collocation with the aircraft also allows investigators low cost, "piggy back" flights (add-on experiments flown on a space available basis). Once these aircraft transfer to DFRC, the opportunity and interest in these "piggyback" experiments will be lost, largely due to additional cost.

***PROGRAM IMPACTS AT
WFF***

The monitoring and research of Atlantic coast waters and bays, as well as calibration and verification of satellite-borne ocean instruments could not be sustained with DFRC-based aircraft due to the programmatic need for numerous missions in specific meteorological and ocean biological conditions. Thus, many of WFF's small but valuable programs could not be performed at DFRC.

***RECURRING AND NON-
RECURRING COSTS***

OIG comments on specific elements of management's assumptions and the associated non-recurring and recurring cost impacts are summarized below:

LABORATORY COSTS

Simulator. In our draft report, we stated that because of consolidation there is an additional requirement to construct a test and development bed (a simulator) at ARC at a cost of \$590,000 so that systems development research on the RASCAL helicopter program can continue. NASA's position on the simulator is that its purchase is a program decision, independent of consolidation. Program officials reaffirmed previously obtained information that if the helicopter remained at ARC, then the simulator's procurement would not be necessary. Only because of consolidation is the simulator (a cockpit, visual system, flight control computer and servo emulator unit/test bench) needed to satisfy research requirements. The OIG reaffirms its position that an additional nonrecurring cost of \$590,000 is needed for laboratory setup costs for RASCAL helicopter research.

The costs of laboratory setup at DFRC could be substantially greater than Code B's assessment. These issues are discussed briefly below. These costs are increased costs of consolidation that must be considered.

Local Area Network (LAN). In addition to LAN workstations, if DFRC were to maintain the same data transmission capability as ARC provided, a T-3 communications line would be required. The installation cost is minimal, \$15,000 (nonrecurring), but the monthly charges will approximate \$45,000 or \$540,000 (recurring) annually. It is possible to meet the science requirements with three T-1 lines at

a reduced cost (installation, \$35,000 and recurring annual costs of \$70,000), but with a substantially increased data transmission time. The preferred approach and industry trend is for a T-3 capability. Again, these costs have not been factored into the consolidation equation. (Note: Just prior to the release of this final report, we received information that Edwards AFB, collocated with DFRC, might have T-3 connectivity. If capacity permits and if a sharing agreement can be negotiated, the potential exists these costs might be lower, but there will be costs. NASA management has not given us any figures on the associated costs.)

ARC estimated that set up and connectivity costs could be as much as \$2.8 million, but because specific requirements have yet to be identified, we did not factor this cost into our results in calculating the 52 year payback period. While all of these employees may not require computer workstations, Code B failed to account for costs in this regard.

WATR. Discussions with DFRC officials regarding WATR capabilities supporting the ARC helicopter research program disclosed that \$990,000 (nonrecurring) is needed and has been budgeted, to provide Telemetry and Radar Acquisition and Processing System (TRAPS) helicopter capability. This expenditure is to recreate this capability at DFRC. According to ARC officials, ARC is one of only three institutions in the nation with this level of capability and NASA does not want to lose it. Because of problems validating these costs and due to time constraints, we did not include this additional laboratory setup expense in calculating the 52 year payback period.

While the aforementioned laboratory costs have not been incorporated into either Code B's or our analyses, it is noteworthy that during an October 30, 1995 meeting at NASA Headquarters, NASA's Associate Administrator of Aeronautics briefed the Assistant to the President for Science and Technology, that laboratory setup costs associated with consolidation would be \$7.7 million. This amount is substantially different than the \$900,000 included in NASA's current assessment.

ADDED TRAVEL

After the issuance of our June 4, 1996 draft report, NASA delivered to the OIG a revised draft assessment lowering LaRC additional travel cost estimates associated with the transfer of the B-757 aircraft to DFRC. LaRC's earlier assessment, previously agreed to by DFRC, stated that \$2,684,700 (nonrecurring) would be necessary to transition

the plane to DFRC. LaRC's revised assessment reduces this estimate to \$118,400.

As of August 9, 1996, the LaRC draft plan was still being revised and because of its tentative status we were unable to audit the revised assumptions and figures. Based on discussions with LaRC officials, it is envisioned that the research flight deck may eventually be added at a later date once funding becomes available, after delivery to DFRC. At that time the design and installation of the flight deck will either be performed by a contractor at DFRC or flown back to LaRC for installation. NASA concluded previously that to have a contractor perform modifications on the aircraft could cost twice as much as performing the work at LaRC. In either case, it will cost more than if the aircraft were to remain at its present location, LaRC, where local mechanics and engineers would perform the modifications.

Preliminary OIG review revealed that the significant reductions in the aircraft's design modifications will result in lower additional travel cost than previously planned with the aircraft's original configuration. This LaRC reassessment of transition costs for the B-757 was not finalized prior to the release of this report. Further, we did not factor in this lower nonrecurring cost, just as we have not included other additional costs discussed above.

We would like to note that the descope plan created the need for significant set-up costs for telescience capabilities and a "WFF-like" environment (where NASA exclusively controls the operational schedule, launch range, and airspace) at DFRC. These would be additional costs which we have not factored into our analysis.

AIRCRAFT PARTS & FUEL

Code B asserted that the savings for transferring two T-38 aircraft from ARC and LaRC to JSC will be \$1.2 million annually. The OIG disagrees. The savings set forth in our June draft report represent the actual savings that will accrue from transferring the T-38 aircraft, currently used for pilot proficiency and chase activities at ARC and LaRC, to JSC and taking two T-38s out of commission. Our operating cost calculations were confirmed by the Chiefs of Aircraft Operations at ARC, LaRC and JSC.

In addition, Code B's assessment has not factored in the added cost of pilot proficiency and chase flights requirements that will be occurring at DFRC to perform the duties of the two T-38s being transferred to JSC. Code B's analysis only recognizes the savings, but did not

account for the additional chase and proficiency costs that will be associated with the aircraft being consolidated at DFRC. DFRC has indicated that any chase support will be performed by a T-34 or F-18 aircraft. DFRC's flight per hour cost for an F-18 is \$4,974, more than twice the cost of a T-38 flight hour.

Moreover, NASA management's attempt to "fully cost" the savings for the two T-38s transferring to JSC appears to double count the savings from the maintenance personnel associated with the aircraft. Under the category: "Recurring Annual Savings: Decommission/Consolidation, A/C Personnel," Code B claimed an annual savings of \$407,446 for the reduction in civil service personnel that accompany terminating the maintenance and operation of the two T-38s at ARC and LaRC. Code B then used the annual average JSC operating cost of \$600,000 per aircraft, which included contractor maintenance and personnel costs, to claim savings under the category "Aircraft Parts and Fuel."

FACILITIES CLOSING

WATR. A detailed independent analysis of this cost is still warranted. The analysis should consider WATR capabilities at ARC that would be terminated regardless of aircraft consolidation. It should also include cost adjustments for not replicating the same level of service at DFRC that ARC currently provides.

We question management's claim of \$1.6 million annual savings. We could not verify the claimed savings based on the documentation and explanations provided by DFRC. Moreover, the data did not account for savings unrelated to aircraft consolidation. For example, the analyses did not account for closing the Crow's Landing portion of the ARC WATR. ARC management estimated this would save approximately \$342,000 annually. This closing, and the associated lower operating costs, would occur regardless of consolidation.

Moffett Federal Airfield (MFA). In our draft report we allowed \$650,000 in recurring savings, which represented ARC's proportionate share of costs associated with maintaining MFA if another agency were to assume host responsibilities. However, based on the NASA Administrator's correspondence to Senator Feinstein, dated April 19, 1996, NASA made a commitment to maintain the airfield under NASA versus shifting control to another federal agency. Thus, the \$650,000 amount is no longer conceptually relevant to estimated savings since this facility cost will remain even after consolidation.

Therefore, this amount should be removed from the annual saving estimates associated with consolidation.

LaRC Facilities. In our draft report we allowed \$209,000 for savings due to the closing of hangar facilities at LaRC. However, discussions with LaRC managers revealed that there are further uses planned for the hangar, and therefore, the hangar would not be closed after the aircraft are consolidated. Uses of the hangar include: housing of the B-757 simulators; hangar space when FAA wants LaRC to install experimental systems on board research aircraft; landing site for administrative aircraft; sheltering of Air Force and Army "out of service" planes during hurricanes; and the site for science symposiums and other NASA public relations functions for which LaRC must maintain electricity and phone service in the hangar. Furthermore, if the future modifications planned for the B-757 aircraft are performed at LaRC, then the hangar as well as airfield capabilities will return to active, operational status. Hence, there will be little, if any, savings from reduced maintenance and utilities of these facilities.

LeRC Facilities. Our draft report included \$110,000 as savings for closing of LeRC hangar facilities. This amount was based upon historical cost data. Code B maintained savings of \$388,211 will be realized by closing facilities at LeRC. Code B based its cost estimate on a NASA facilities assessment prepared in June 1994. However, in a letter directed to NASA HQ, dated February 9, 1996, LeRC stated:

"...the LeRC hangar maintenance costs in the facilities assessment document are not real costs, i.e., they are not based on actual expenditures. They are, in fact, only estimates of costs to upgrade the LeRC hangar to 'new' condition...the sum of our actual maintenance and utility costs came to \$103,000 - \$118,000 based on a best case/worst case usage of natural gas. Please note that if the LeRC hangar is closed, but maintained in a dormant mode, it will still cost about \$50,000 per year for heat, electricity and minimum maintenance. Therefore, the cost savings to NASA should really be \$52,000 - \$65,000."

The OIG believes it has been conservative by factoring in LeRC facilities savings at \$110,000.

WFF Facilities. In our draft report, we allowed \$401,000 for savings due to the closing of hangar facilities at WFF. However, based on the NASA Administrator's testimony to Senator Mikulski that NASA was

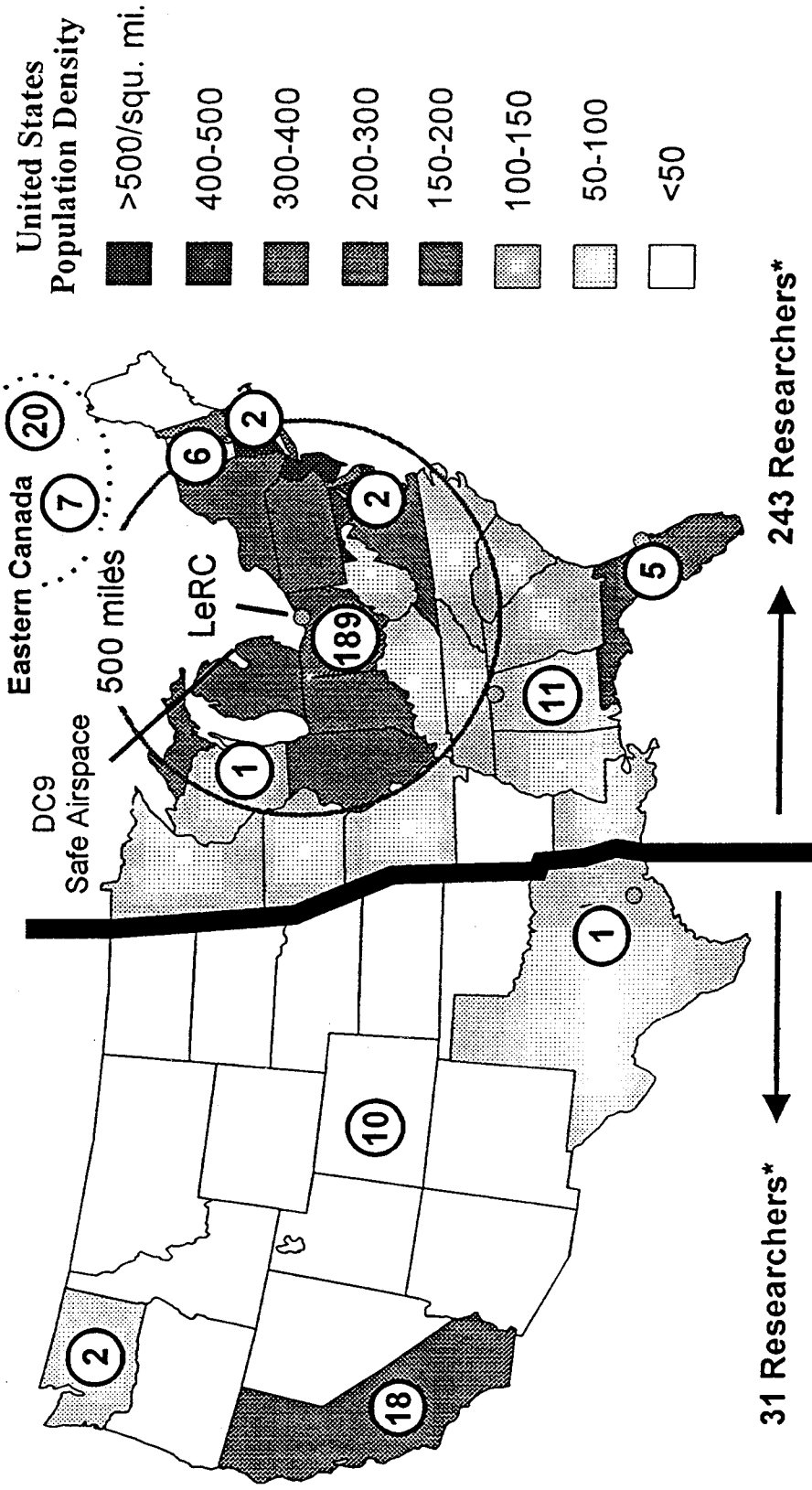
not going to move WFF to DFRC, we believe that the hangar facilities will not be closed and thus these annual savings should be recalculated in the consolidation analysis.



Microgravity Science and Applications Program

DC-9 Demographics of Researchers

Time Covered - June 95 to June 96



* Researchers includes Principal Investigators, Ground Investigators, Project Scientists, and Research Support Staff

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Appendix V

Aircraft Photographs

and

Program Descriptions

Ames Research Center

Mission: Airspace Operations Systems and Astrobiology

Center of Excellence: Information Technology

Proposed Realignments: Establish a science institute for astrobiology, retain core in-house aeronautics research capability, consolidate management of aeronautics facilities with Langley Research Center facilities, transfer Moffett airfield, transfer aircraft to Dryden Flight Research Center.

<u>Aircraft No.</u>	<u>Model</u>	<u>Program Code</u>	<u>Current Program Usage</u>	<u>Owner</u>	<u>Disposition</u>
705	Lear 24	R	Infrared measurements	NASA	Consolidation
706	ER-2	Y	High altitude remote sensing research	NASA	Consolidation*
709	ER-2	Y	High altitude remote sensing research	NASA	Consolidation*
717	DC-8	Y	Airborne earth science research	NASA	Consolidation*
718	YO-3A	R	Acoustics research	NASA	Consolidation
736	NAH-1S	R	Display	U.S. Army	Consolidation
748	UH-60	R	Rotorcraft Aircrew Systems Concepts Airborne Lab (RASCAL)	U.S. Army	Consolidation
750	UH-60	R	Airloads	U.S. Army	Consolidation*
910	T-38	R	Pilot proficiency	NASA	Consolidation
701	BE200	R	Global Positioning System (GPS)	NASA	Decommission
703	XV-15	R	Tilt rotor acoustic project	NASA	Decommission
704	YAV-8B	R	Vertical/Short Take off and Landing Research	U.S. Navy	Store
707	C-130B	Y	None	NASA	Decommission
708	ER-2	Y	High altitude remote sensing research	USAF	Transf. to USAF
714	C-141	S	Keiper Airborne Observatory	NASA	Store at DFRC
719	AV-8C	R	None	U.S. Navy	Display
734	UH-1	R	None	NASA	Decommission
749	UH-60	R	None	U.S. Army	Transf. to U.S. Army

*Aircraft picture and program description attached.



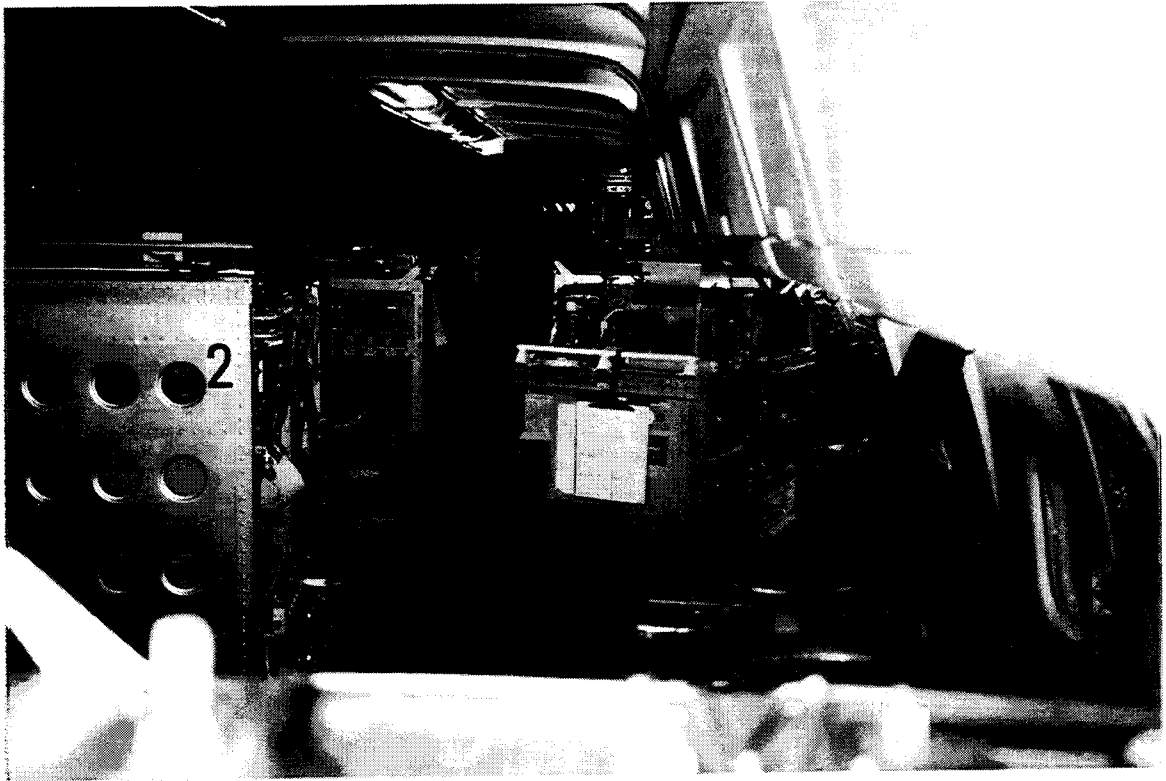
ER-2 MONTAGE

ER-2 IN FLIGHT - Three high altitude earth resources ER-2 are operated worldwide in support of scientific projects sponsored by NASA and other federal, state, university, and industry investigations. The ER-2 is a versatile aircraft well suited to multiple mission work. Capable of carrying over 2,700 pounds of data acquisition equipment, as many as 15 systems have been operated simultaneously. The long range capability of over 3,000 nautical miles and flight duration in excess of 8 hours at altitudes above 70,000 feet allows for extremely large area coverage in a single flight at near space environment.

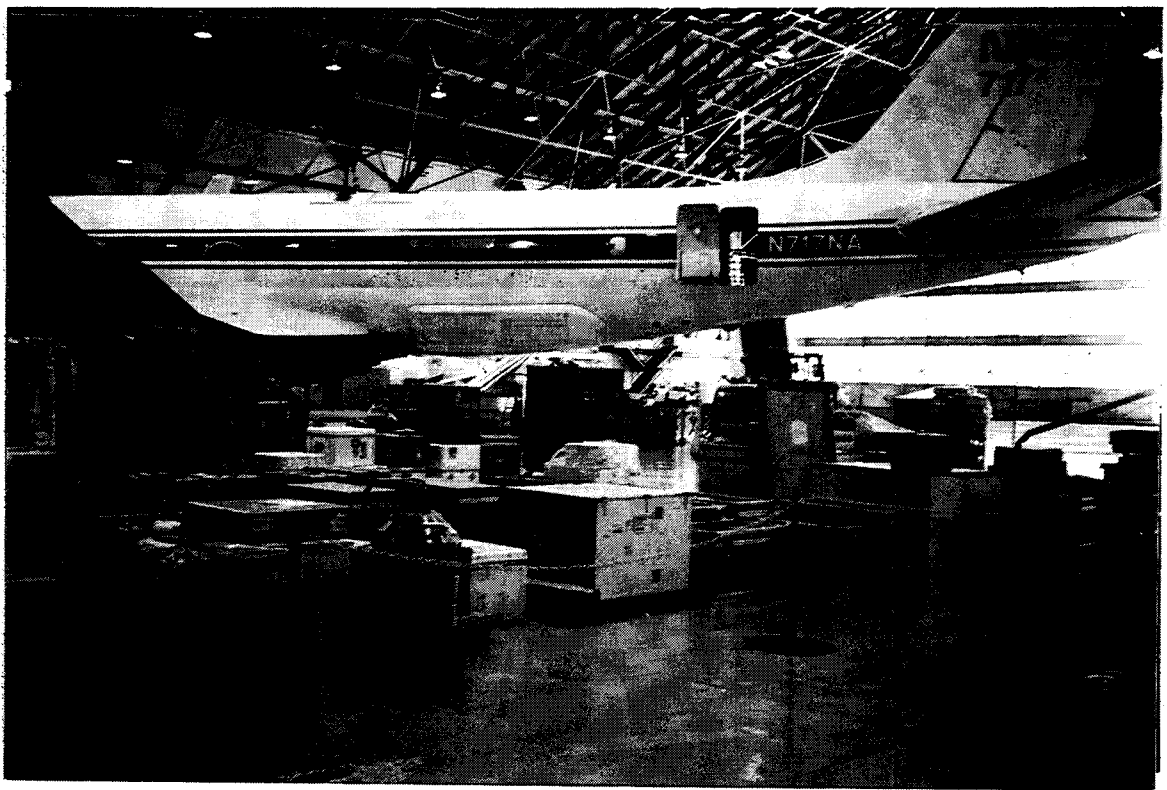


THE DC-8 AIRBORNE LABORATORY

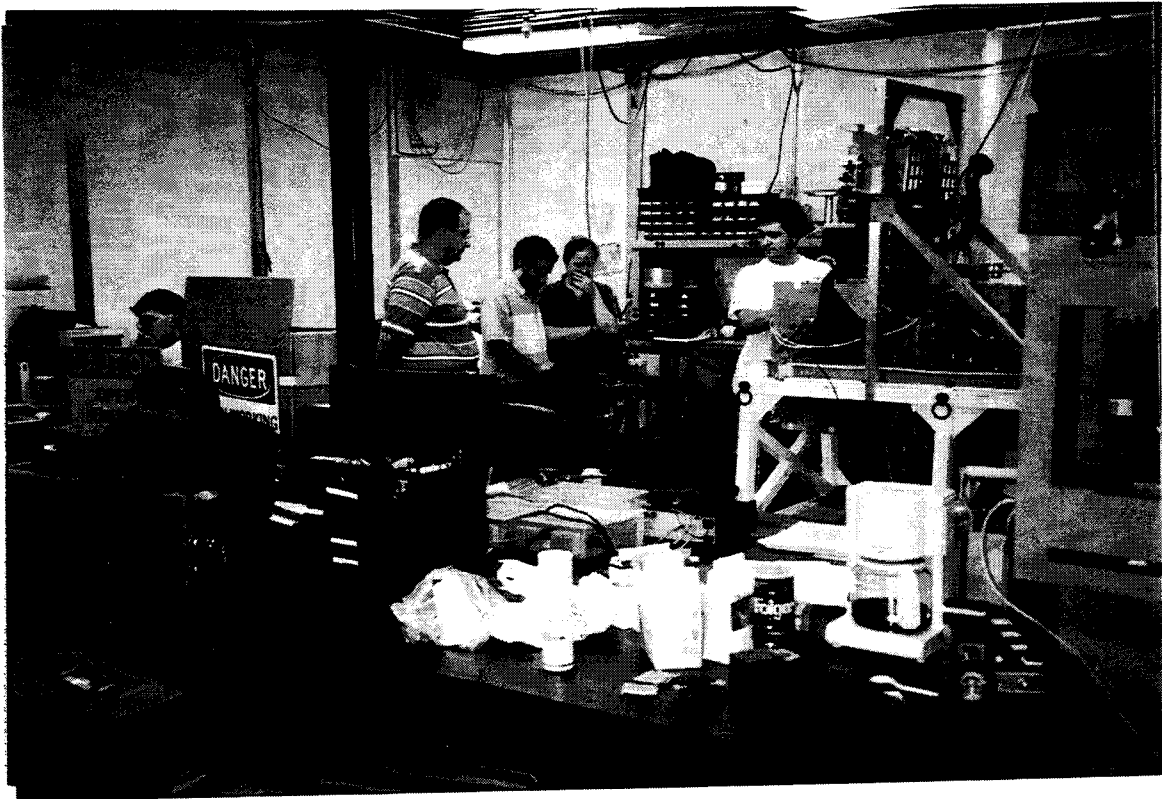
The DC-8 Airborne Laboratory is a medium altitude, four engine jet aircraft with a range in excess of 5,000 nautical miles, a ceiling of 41,000 feet and an experiment payload of 30,000 lbs. It is equipped with 17 large aperture view ports capable of accommodating up to a 16-inch diameter window, in a variety of materials for viewing in four directions. These and two 30 x 37 inch downward looking view ports are equipped with hard points for mounting experiments or air sampling probes. A variety of special systems have been incorporated in the aircraft to support a wide range of research programs. As many as 30 scientists working on 14 different experiments have been accommodated simultaneously.



INSIDE DC-8



DC-8 EXPERIMENTER LOAD



EXPERIMENTAL LAB ARC BUILDING-144

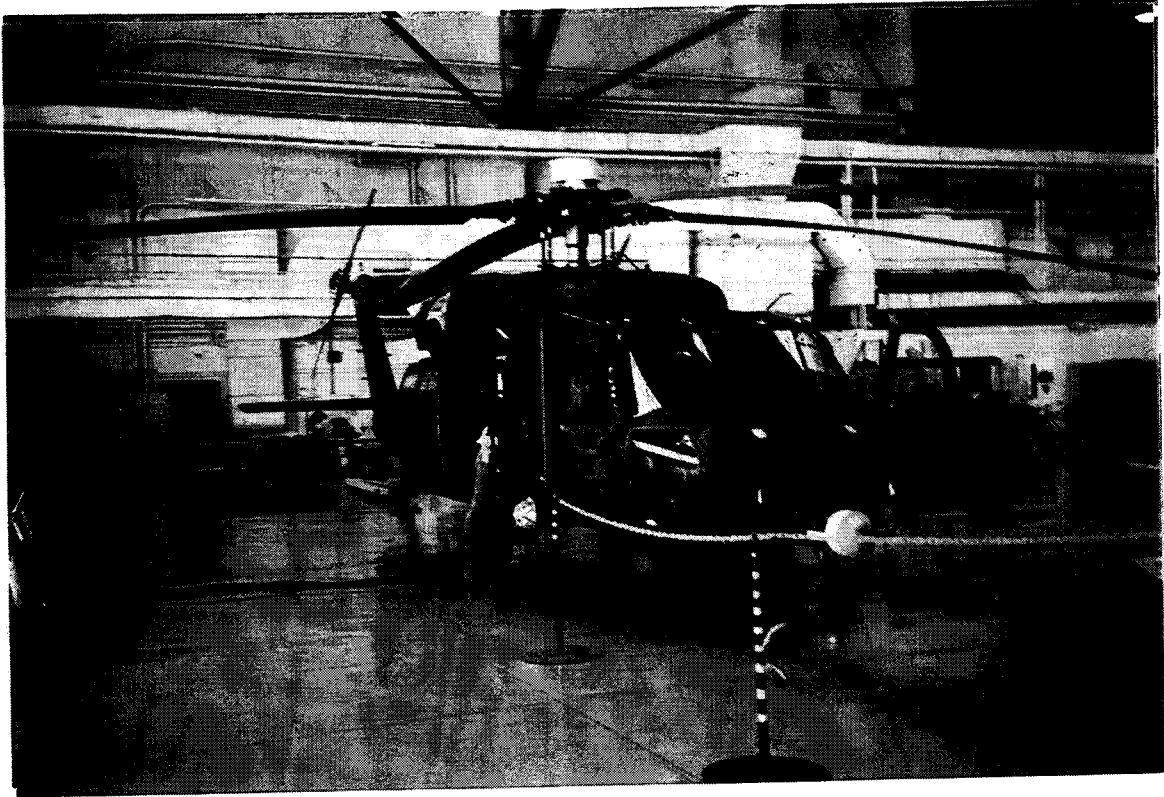


DC-8 EXPERIMENTER LOAD



ROTCRAFT/AIRCREW SYSTEMS CONCEPTS AIRBORNE LABORATORY (RASCAL)

The RASCAL is a highly modified UH-60 incorporating a full authority fly-by-wire flight control system, an integrated research architecture, complete data instrumentation package, and precision navigation system. Program objectives are to flight-demonstrate advanced flight control, electronic display, and guidance concepts, generated by NASA/Army military and civil rotorcraft programs. The RASCAL fly-by-wire flight control system provides a highly flexible facility for investigation of rotorcraft handling qualities, operational issues, and system integration technologies, for industry and government customers.



UH-60 RASCAL



UH-60 RASCAL

Dryden Flight Research Center

Mission: Flight Research

Center of Excellence: Atmospheric Flight Operations

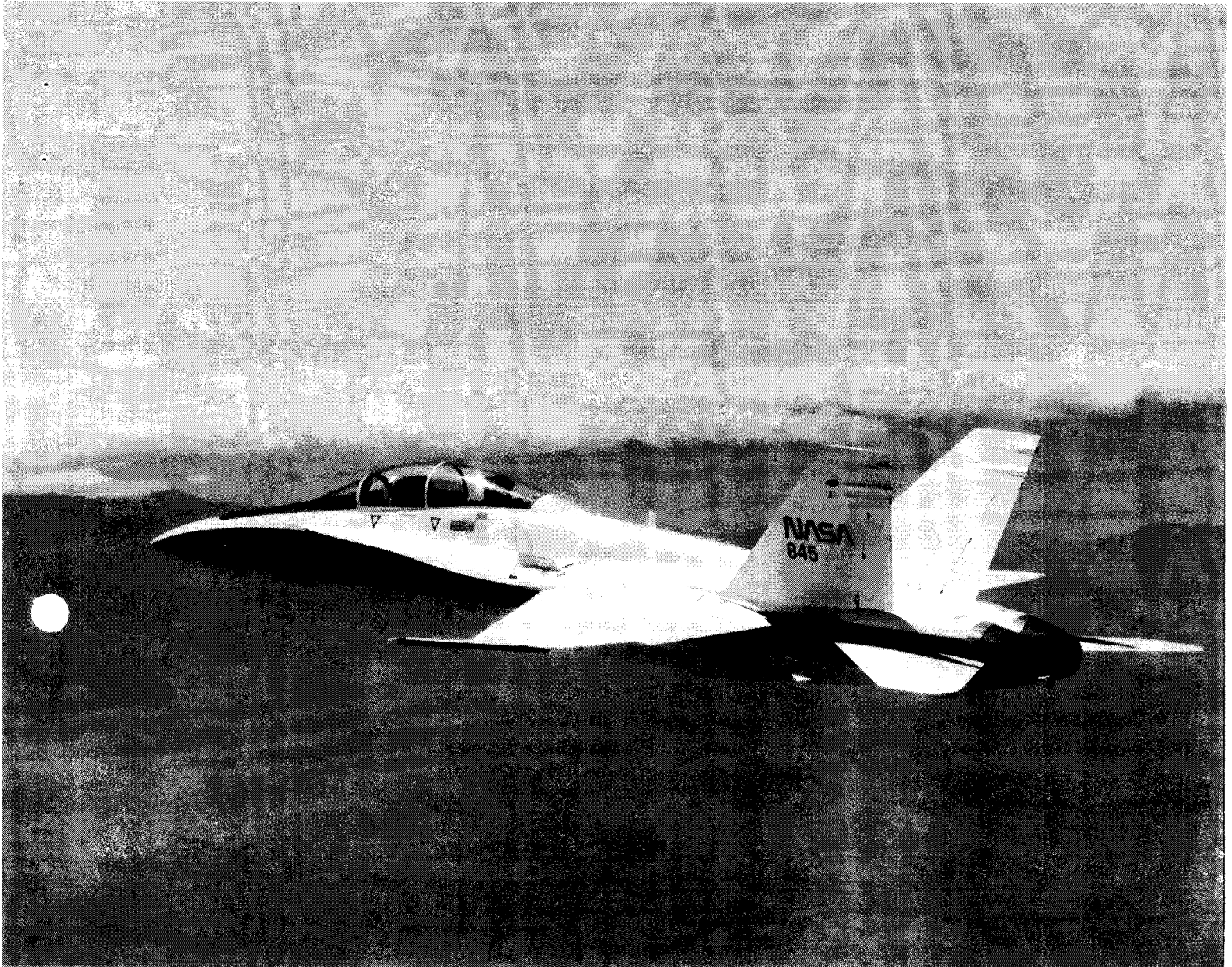
Proposed Realignment: Assume flight operations management of all aircraft except those in support of the Space Shuttle.

<u>Aircraft No.</u>	<u>Model</u>	<u>Program Code</u>	<u>Current Program Usage</u>	<u>Owner</u>	<u>Disposition</u>
008	B-52	R	Parachute recovery system for the F-111 crew escape module	USAF	N/A
585	X-31	R	Enhanced Fighter Maneuverability (EFM) research	U.S. Navy	N/A
750	F-16A	R	Air flow research	USAF	N/A
808	PA-30	R	On indefinite loan to King's River Community College	NASA	N/A
810	CV-990	M	Space Shuttle landing gear assemblies testing	NASA	N/A
816	F-16A	R	Air flow research	USAF	N/A
831	SR-71	R	High speed, high altitude research	USAF	N/A
836	F-15B	R	Flight Test Fixture-II testbed for aerodynamics/fluid mechanics	NASA	N/A
837	F-15B	R	Advanced Control Technology for Integrated Vehicles (ACTIVE)	USAF	N/A
840	F-18A	R	High Angle of Attack Research Vehicle (HARV)	U.S. Navy	N/A
843	F-18A	R	Chase & pilot proficiency	U.S. Navy	N/A
844	SR-71	R	High speed, high altitude research	USAF	N/A*
845	F-18B	R	Systems Research Aircraft (SRA)	U.S. Navy	N/A*
846	F-18B	R	Chase & pilot proficiency	U.S. Navy	N/A
847	F-18A	R	Chase & pilot proficiency	U.S. Navy	N/A
848	F-16XL	R	Laminar flow at supersonic speeds	USAF	N/A*
849	F-16XL	R	Laminar flow at supersonic speeds	USAF	N/A
850	F-18A	R	Chase & pilot proficiency	U.S. Navy	N/A
851	F-18A	R	Chase & pilot proficiency	U.S. Navy	N/A
852	F-18B	R	Chase & pilot proficiency	U.S. Navy	N/A
905	B-747	M	Shuttle Carrier Aircraft	NASA	N/A*
911	B-747	M	Shuttle Carrier Aircraft	NASA	N/A

Aircraft picture and program description attached.



SR-71 "The Blackbird" - The SR-71 can fly more than 2,200 mph (Mach 3+ or more than three times the speed of sound) and at altitudes of over 85,000 feet. This operating environment makes the aircraft excellent platforms to carry out research and experiments in a variety of areas -- aerodynamics, propulsion, structures, thermal protection materials, high-speed and high-temperature instrumentation, atmospheric studies, and sonic boom characterization.

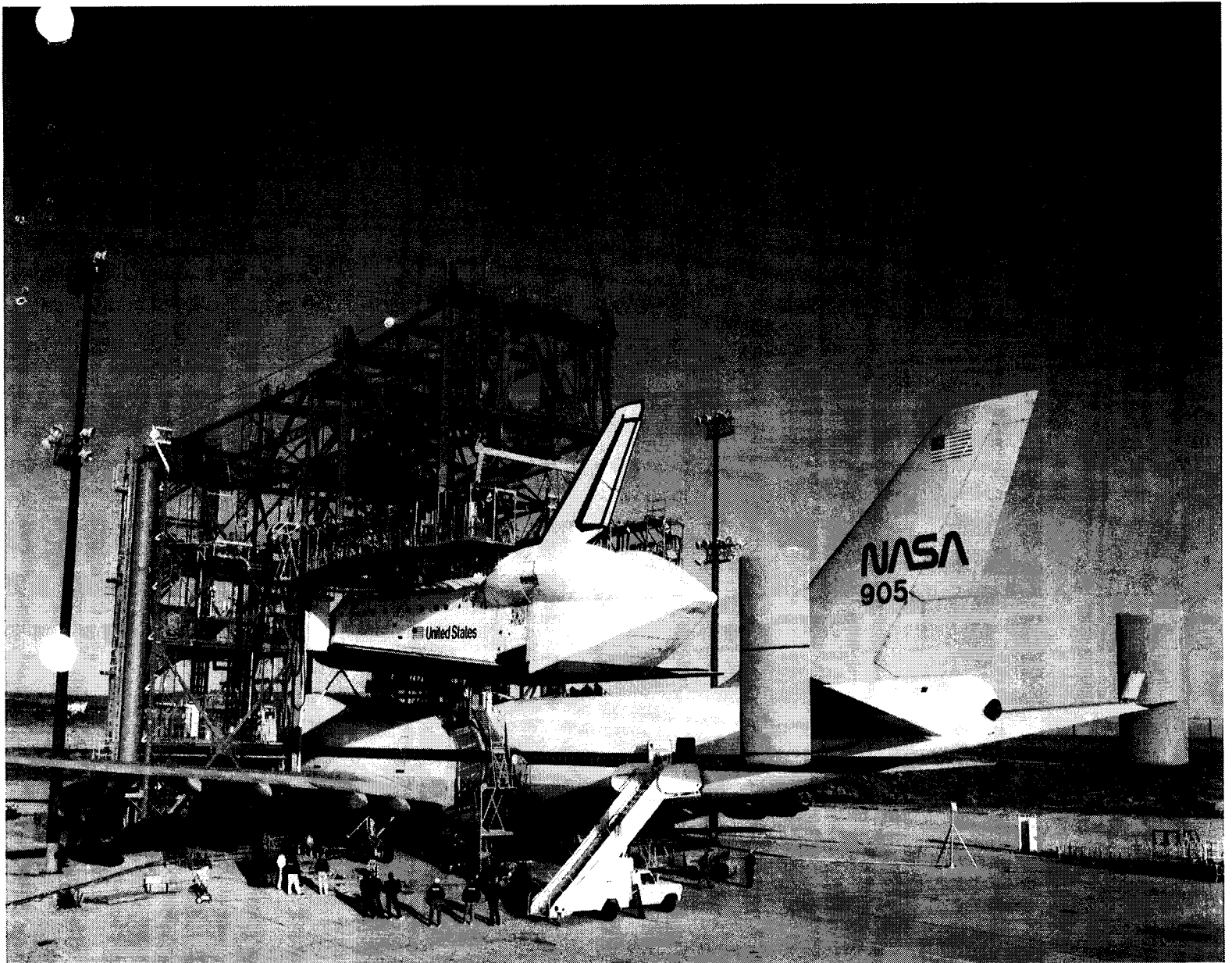


18 SYSTEMS RESEARCH AIRCRAFT - The NASA Dryden Flight Research Center is using an F/A-18 Hornet fighter aircraft as its Systems Research Aircraft (SRA). The aircraft is on loan from the U. S. Navy. The SRA project will help ensure that new aerospace concepts are transferred to the U. S. aerospace industry to accelerate transition of new technologies to commercial and military aircraft and space vehicles. Key technologies that are being investigated by the F-18 SRA include advanced power-by-wire concepts, electric powered actuators and mechanical systems, fly-by-light (fiber-optic cable) systems, and advanced computer architectures. Future aircraft that will benefit are the high speed civil transports.

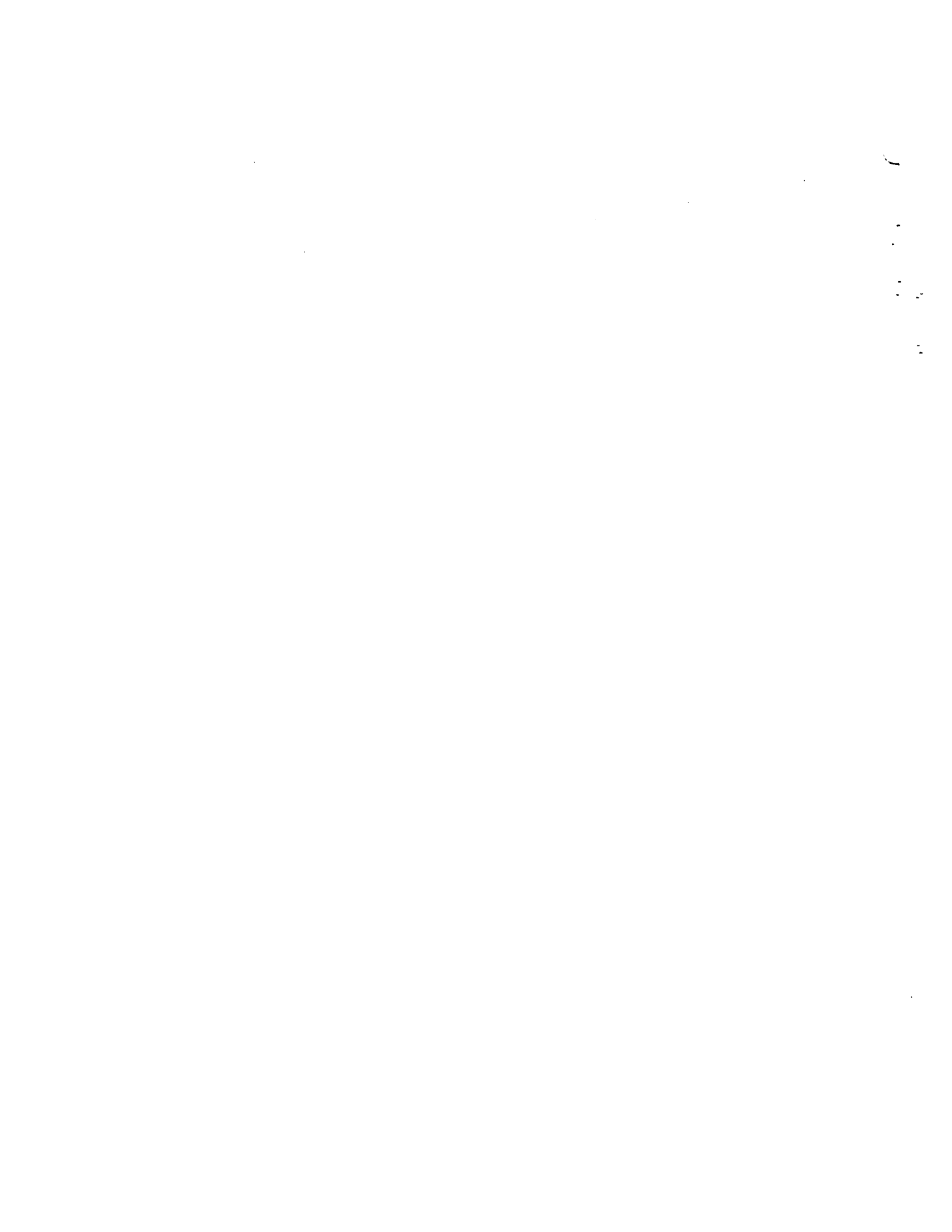


F-16XL LAMINAR FLOW RESEARCH AIRCRAFT

An F-16XL aircraft is being used by the Dryden Flight Research Center, Edwards, California, in a NASA-wide program to improve laminar airflow on aircraft flying at sustained supersonic speeds. It is the first program to look at laminar flow on swept wings at speeds faster than sound.



NASA 747 Shuttle Carrier Aircraft - Used to ferry Shuttle aircraft from Dryden Flight Research Center to Kennedy Space Center.



Langley Research Center

Mission: Airframe Systems, Aerodynamics, and Atmospheric Science

Center of Excellence: Structures and Materials

Proposed Realignments: Provide program analysis and evaluation function for Agency, transition atmospheric science to an institute, transfer aircraft to Dryden Flight Research Center.

Aircraft No.	Model	Program Code	Current Program Usage	Owner	Disposition
509	T-34C	R	Chase aircraft for the B-737/757 program	U.S. Navy	Consolidation
511	T-38	R	Pilot Proficiency	NASA	Consolidation
524	OV-10A	R	Advanced subsonics, wake vortex	NASA	Consolidation
535	UH-1H	R	Model drop testing	NASA	Consolidation
557	B-757	R	Transportation System Research Vehicle (TSRV)	NASA	Consolidation*
506	BE-80	R	None	NASA	Decommission
515	B-737	R	TSRV	NASA	Decommission
518	U21A	R	None	NASA	Decommission
566	Lear 28	R	None	NASA	Decommission

***Aircraft picture and program description attached.**



NASA LANGLEY'S 2ND GENERATION 'FLYING LAB' ARRIVES AT NEW HOME

On May 19, 1994, NASA Langley's Boeing 757-200 arrived at its new home in Hampton, Virginia. The aircraft will serve as NASA Langley's "flying laboratory" for aeronautical research. Originally used by Boeing for Federal Aviation Administration certification of the 757 class of jet airlines, the digitally-equipped transport was obtained from the Eastern Airline bankruptcy estate.

Lewis Research Center

Mission: Aeropropulsion

Center of Excellence: Turbomachinery

Proposed Realignments: Transfer Atlas-Class expendable launch vehicle management to Kennedy Space Center, retain Plumbrook on a fully-reimbursable basis, establish an institute for microgravity and space power, close the rocket engine test facility, transfer aircraft to Dryden Flight Research Center.

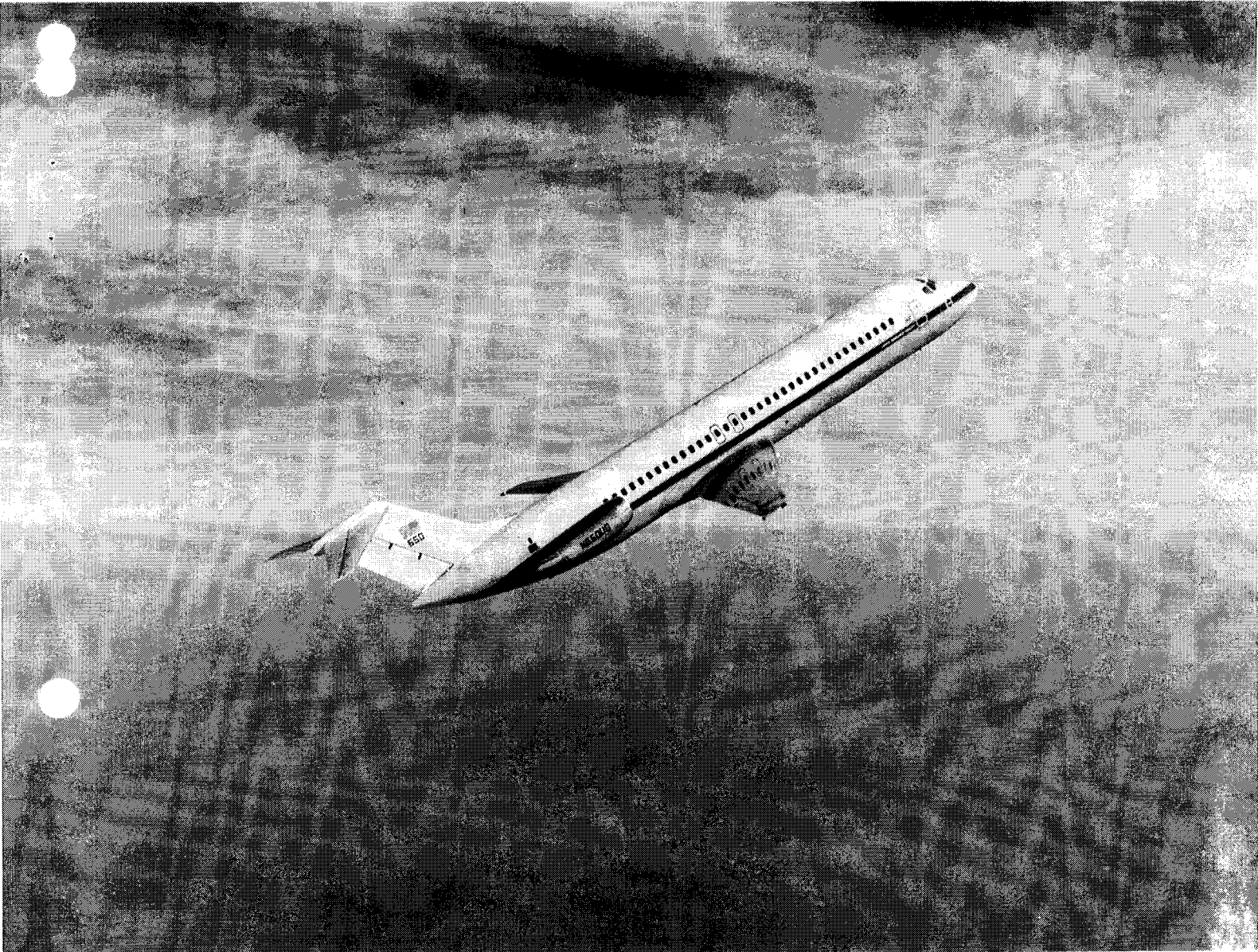
Aircraft		Program		Owner	Disposition
No.	Model	Code	Current Program Usage		
607	DH-6	R	Icing research	NASA	Consolidation*
616	Lear 25	R	Airborne science	NASA	Consolidation
618	T-34C	R	Remote sensing	U.S. Navy	Consolidation
650	DC-9	U	Microgravity research	D. O. E.	Consolidation*
614	T-34B	R	None	NASA	Decommission
3615	OV-10D	R	None	NASA	Decommission
619	T-34C	R	Propulsion, acoustics research	U.S. Navy	Decommission
636	T-34C	R	None	NASA	Transf. to U.S. Navy

*Aircraft picture and program description attached.

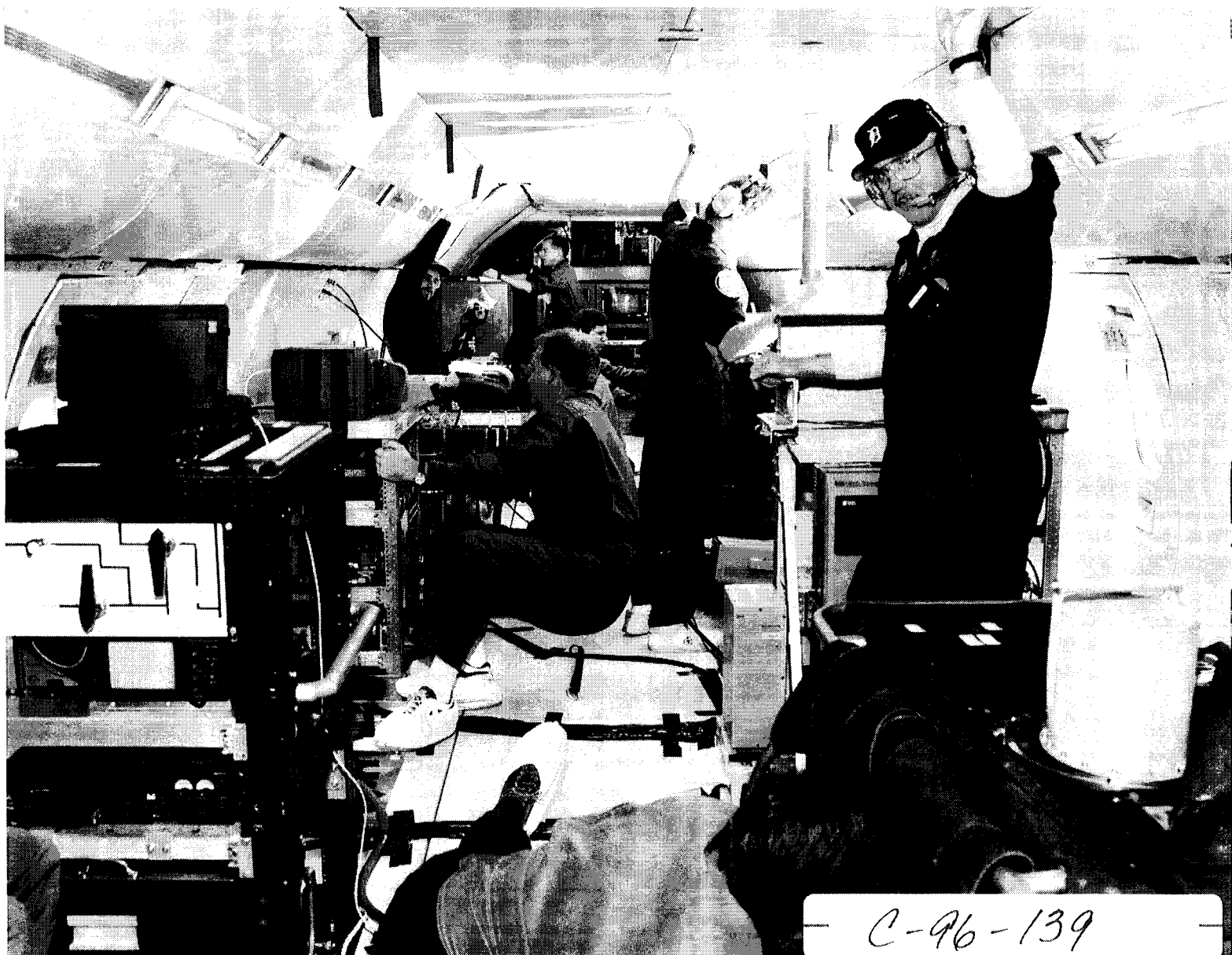


Lewis' DC-6 Icing Research Aircraft - Supports Lewis' Icing Technology Program in Supercooled Large Water Droplet Research.





Boeing' DC-9 Microgravity Research Test - Supports scientific investigations in Combustion Fluid Transport and materials science.



DC-9 EXPERIMENTAL LOADS



DC-9 EXPERIMENTAL LOADS

Goddard Space Flight Center/Wallops Flight Facility

Mission: Earth Science/Physics and Astronomy

Center of Excellence: Science Research

Proposed Realignments: Transfer Goddard Institute for Space Studies to a university/consortium, consolidate management of the Suborbital program at Goddard, reduce cost of Wallops Flight Facility operations and investigate additional cost-sharing opportunities, increase partnerships with NOAA, consolidate management of communications infrastructure at Johnson Space Center, privatize space science data archiving and distribution, reduce in-house spacecraft development, transfer aircraft to Dryden Flight Research Center.

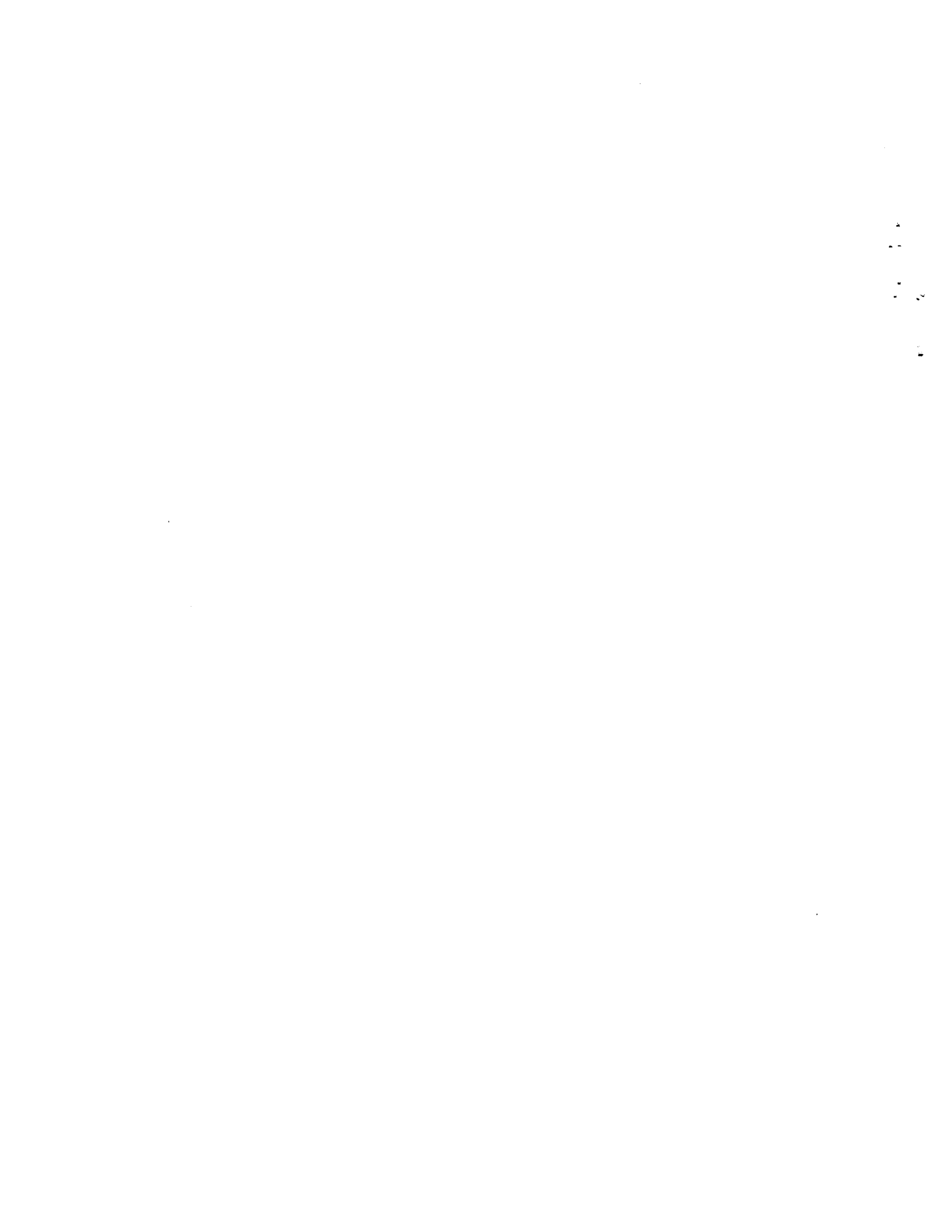
<u>Aircraft</u> <u>No.</u>	<u>Model</u>	<u>Program</u> <u>Code</u>	<u>Current Program Usage</u>	<u>Owner</u>	<u>Disposition</u>
425	T-39E	Y	Laser altimeter, Light Detection and Ranging (LIDAR) programs	NASA	Consolidation
426	P-3B	Y	Greenland ice cap mapping, LIDAR programs	NASA	Consolidation*
427	C-130Q	Y	Global Positioning System, laser altimeter programs	NASA	Consolidation
415	UH-1H	Y	None	NASA	Decommission
432	F-27	Y	Range Support	NASA	Decommission

*Aircraft picture and program pescription attached.



P-3B

The P-3B Aircraft is one of Wallops science aircraft capable of responding quickly and covering remote and large areas make them a very useful tool in conducting scientific research. Equipped with computers, lasers, radars and other instruments, the aircraft are scientific platforms used to study Earth and space, monitor and develop satellite instruments and provide disaster assistance. The aircraft support projects worldwide conducted by NASA, federal, state, academic, and foreign researchers.



John C. Stennis Space Center

Mission: Propulsion Test

Center of Excellence: Propulsion Test

Proposed Realignments: Assume management of White Sands Test Facility from Johnson Space Center, manage all future rocket propulsion testing, pursue National Propulsion Test Alliance.

<u>Aircraft</u>	<u>Program</u>				
<u>No.</u>	<u>Model</u>	<u>Code</u>	<u>Current Program Usage</u>	<u>Owner</u>	<u>Disposition</u>
933	Lear 23	M	Environmental Science	NASA	Commercialize

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Ames Research Center
Dryden Flight Research Center
Goddard Space Flight Center/Wallops Flight Facility
Johnson Space Center
Langley Research Center
Lewis Research Center

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Deputy Associate Director, Energy and Science Division, Office of Management and Budget
Budget Examiner, Energy Science Division, Office of Management and Budget
Associate Director, National Security and International Affairs Division,
General Accounting Office

Chairman and ranking minority member of each of the following congressional committees and subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on VA-HUD-Independent Agencies
Senate Committee on Commerce, Science and Transportation
Senate Subcommittee on Science, Technology and Space
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on VA-HUD-Independent Agencies, Committee on Appropriations
House Committee on Government Reform and Oversight
House Subcommittee on Space and Aeronautics, Committee on Science
House Committee on Science

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